SPECIFICATION
FOR
LCD Module
KD050FWFPA011-LVDS

MODULE:	KD05FWFPA011-LVDS
CUSTOMER:	

REV	DESCRIPTION	DATE
1.0	FIRST ISSUE	2017.03.04
1.1	Update all	2017.11.15

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

Date	Rev. No.	Page	Summary
2017.03.04	V1.0	ALL	FIRST ISSUE
2017.11.15	V1.1	ALL	Update

Contents

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT LCD Panel, driver circuit, back-light unit. The resolution of a 5.0" TFT-LCD contains 800X480 pixels, and can display up to 16.7M colors.

* Features

-Low Input Voltage: 3.3V(TYP)

-Display Colors of TFT LCD: 16.7M colors

-TFT Interface: 8Bit LVDS Interface

-CTP Interface: I2C

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	61.56(H) *109.53(V) (5.0 inch)	mm	-
CTP View area	62.56(H)*110.53(V)	mm	
Driver element	TFT active matrix	-	-
Display colors	16.7M	colors	-
Number of pixels	480(RGB)*854	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.12825 (H) x 0.12825 (V)	mm	-
Viewing angle	Free	o'clock	-
CTP Driver IC	GT911		
Display mode	Transmissive/Normally Black	-	-
Touch mode	Five point		
Operating temperature	-20～+70	℃	-
Storage temperature	-30～+80	℃	-

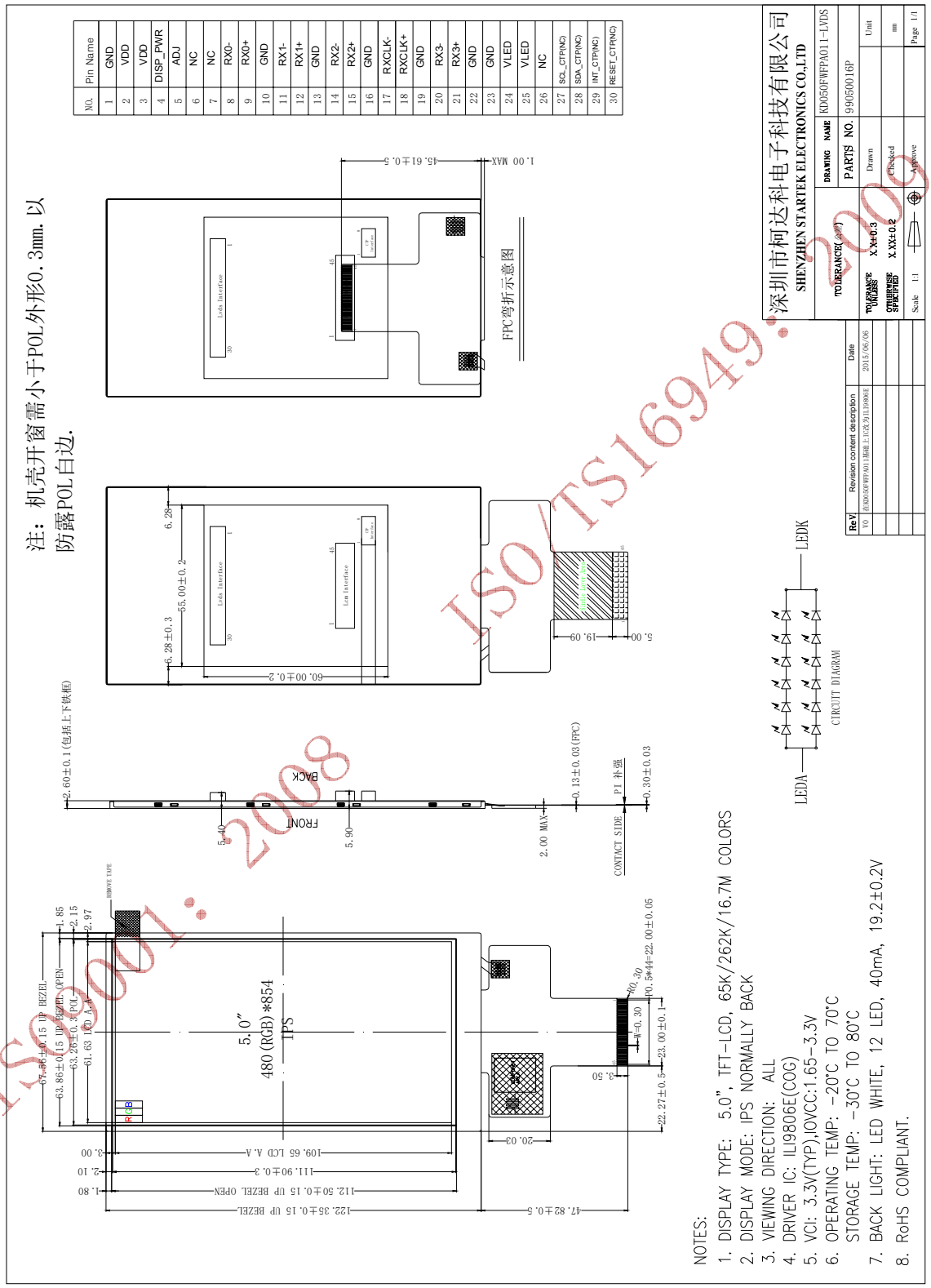
* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		67.56		mm	-
	Vertical(V)		122.35		mm	-
	Depth(D)		2.6	5.9	mm	-
Weight			TBD		g	-

1. Block Diagram

----TBD---

2. Outline dimension



3. Input terminal Pin Assignment

3.1 LCM+CTP

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	VDD	Supply voltage(3.3V).	P
3	VDD	Supply voltage(3.3V).	P
4	DISP_PWR	Display control PIN. H: Sleep mode and BL off. L: Display and BL ON.	P
5	ADJ	1.BL Driver ON/OFF Control pin 2.PWM and digital dimming input.	P
6	NC	No connection	
7	NC	No connection	
8	RXIN0-	- LVDS differential data input	I
9	RXIN0+	+ LVDS differential data input	I
10	GND	Ground.	P
11	RXIN1-	- LVDS differential data input	I
12	RXIN1+	+ LVDS differential data input	I
13	GND	Ground.	P
14	RXIN2-	-LVDS differential data input	I
15	RXIN2+	+ LVDS differential data input	I
16	GND	Ground.	P
17	RXCLK-	- LVDS differential clock input	I
18	RXCLK+	+ LVDS differential clock input	I
19	GND	Ground.	P
20	RXIN3-	-LVDS differential data input	I
21	RXIN3+	+ LVDS differential data input	I
22	GND	Ground.	P
23	GND	Ground.	P

24	VLED	Backlight Supply voltage(+12V).	P
25	VLED	Backlight Supply voltage(+12V).	P
26	NC	No connection	
27	SCL_CTP	I2C clock input.	I
28	SDA_CTP	I2C data input and output	I/O
29	INT_CTP	External interrupt to the host.	I
30	RESET_CTP	No connection	I

4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	640	800	--		(1)(2)
Response time	Rising	T_R		--	16	21	msec	(1)(3)
	Falling	T_F		--	19	24		
Color gamut		S(%)		--	70	--	%	C-light
LCM Luminance		Lv		400	450	--	cd/m2	
Color Filter Chromacicity	White	W_X		0.264	0.304	0.344	-	(1)(4) CF glass
		W_Y		0.302	0.342	0.382		
	Red	R_X		0.622	0.642	0.662		
		R_Y		0.326	0.346	0.366		
	Green	G_X		0.300	0.320	0.340		
		G_Y		0.596	0.616	0.626		
	Blue	B_X		0.122	0.142	0.162		
		B_Y		0.059	0.079	0.099		
Viewing angle	Hor.	Θ_L	CR>10	--	80	--	-	(1)(4) Measuring with Polarizer, Reference Only
		Θ_R		--	80	--		
	Ver.	Θ_U		--	80	--		
		Θ_D		--	80	--		
Option View Direction		Free						

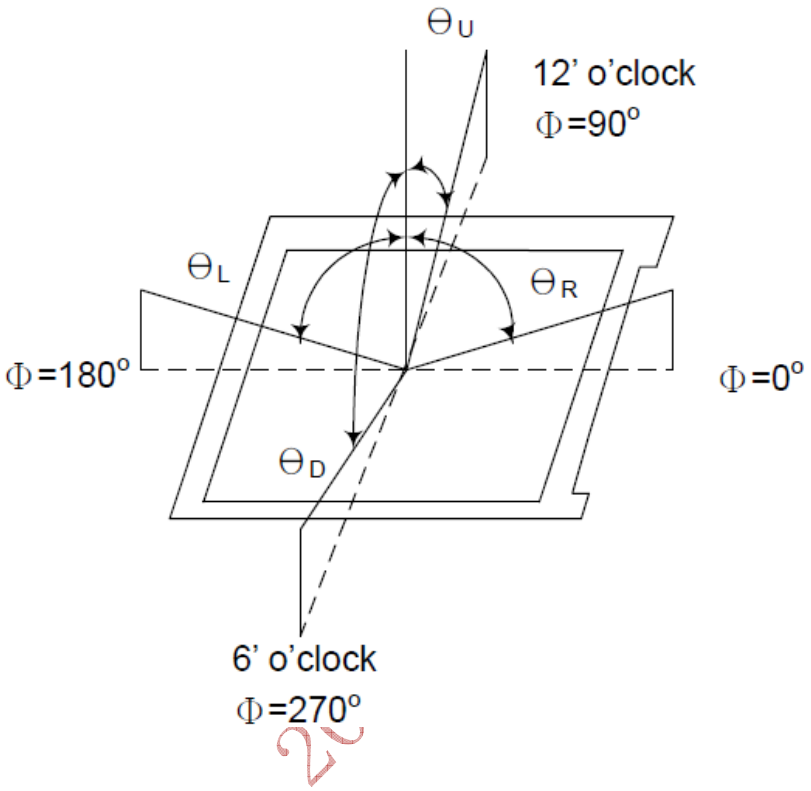
4.2 Measuring Condition

- Measuring surrounding：dark room
- Ambient temperature：25±2℃
- 15min. warm-up time.

4.3 Measuring Equipment

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

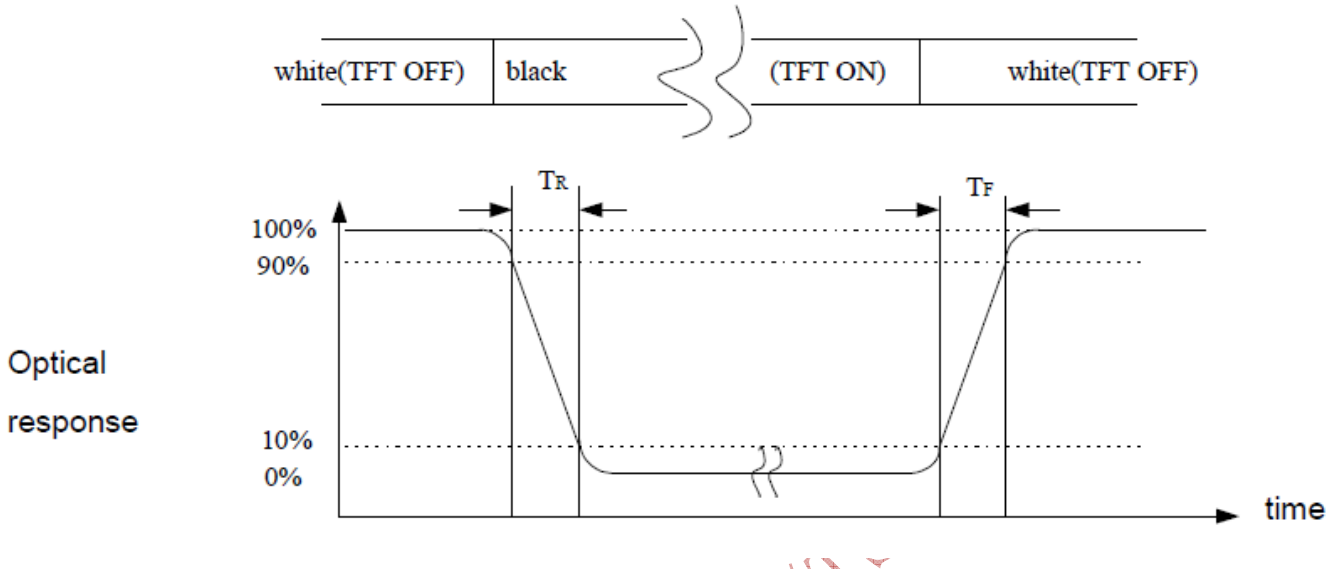
Note (1) Definition of Viewing Angle:



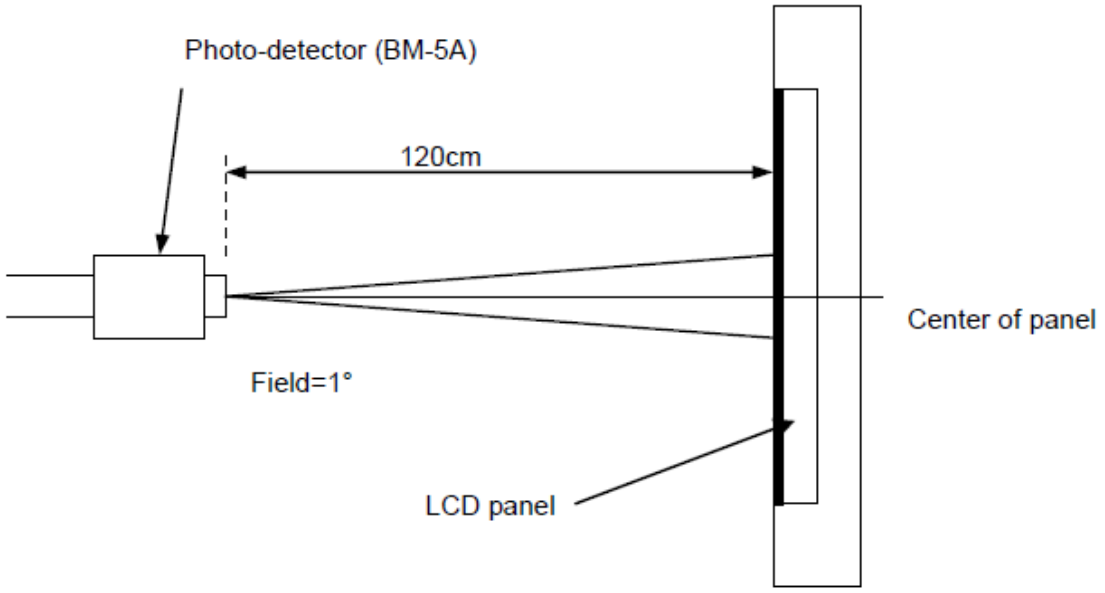
Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

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

Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Ratings

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VDD	-0.3	+4.0	**V**
CMOS/TTL input voltage	--	-0.3	VDD+0.3	
CMOS/TTL Output voltage	--	-0.3	VDD+0.3	
LVDS Input pin	--	-0.3	VDD+0.3	**V**
Operating temperature	T_{OP}	-20	+70	℃
Storage temperature	T_{ST}	-30	+80	℃

5.2 Typical Operation Conditions

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	
Normal mode Current consumption	IDD	--	100	--	mA	
Input logic high voltage	V_{IH}	0.8V_{DD}	--	3.6	V	
Input logic low voltage	V_{IL}	0	--	0.2VDD	V	

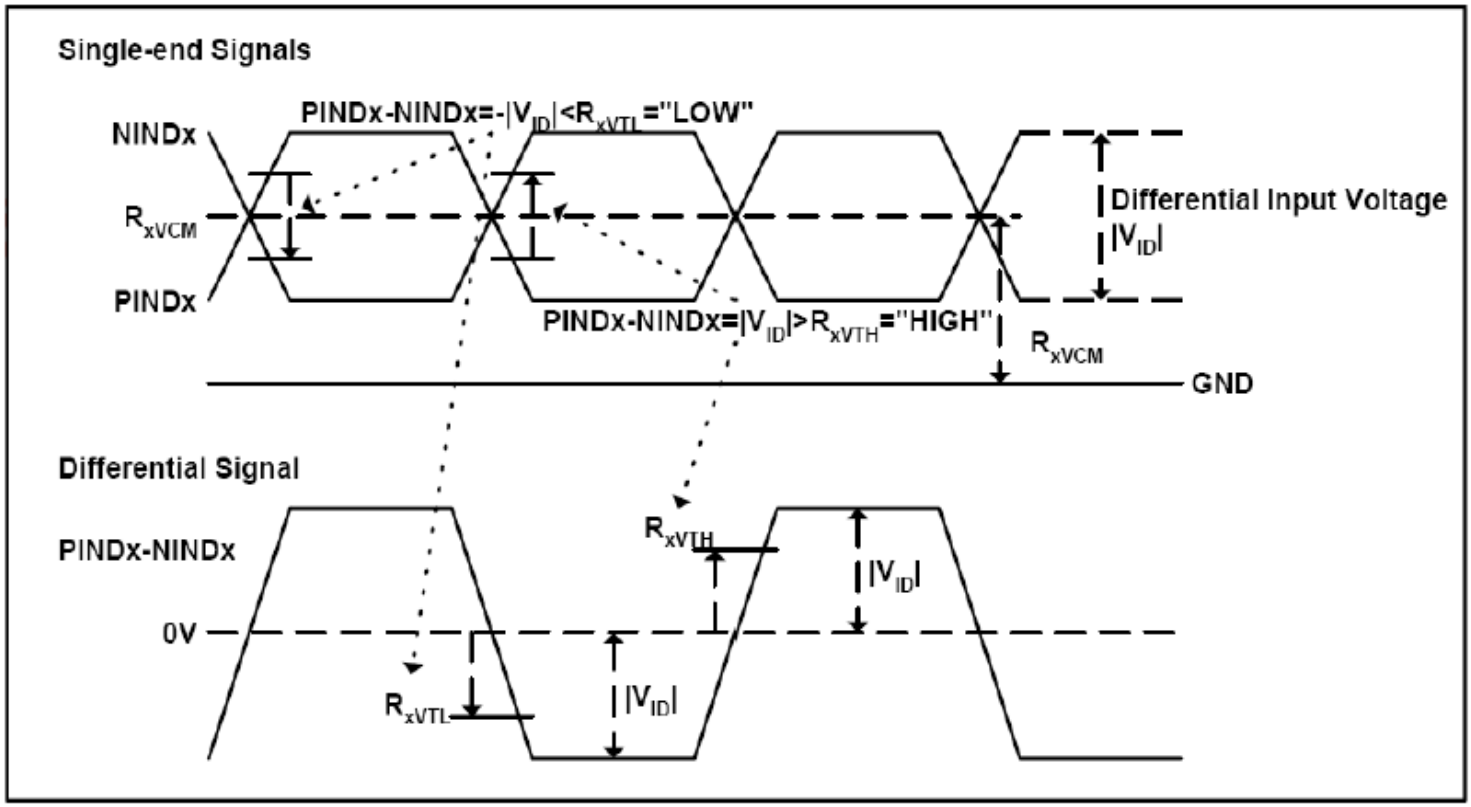
5.3 Backlight Driving Conditions

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VLED	--	+12	--	V	
Normal mode Current consumption	IDD	--	300	--	mA	
PWM dimming frequency	Fdim	5	--	100	KHZ	

6. LVDS Signal Timing Characteristics

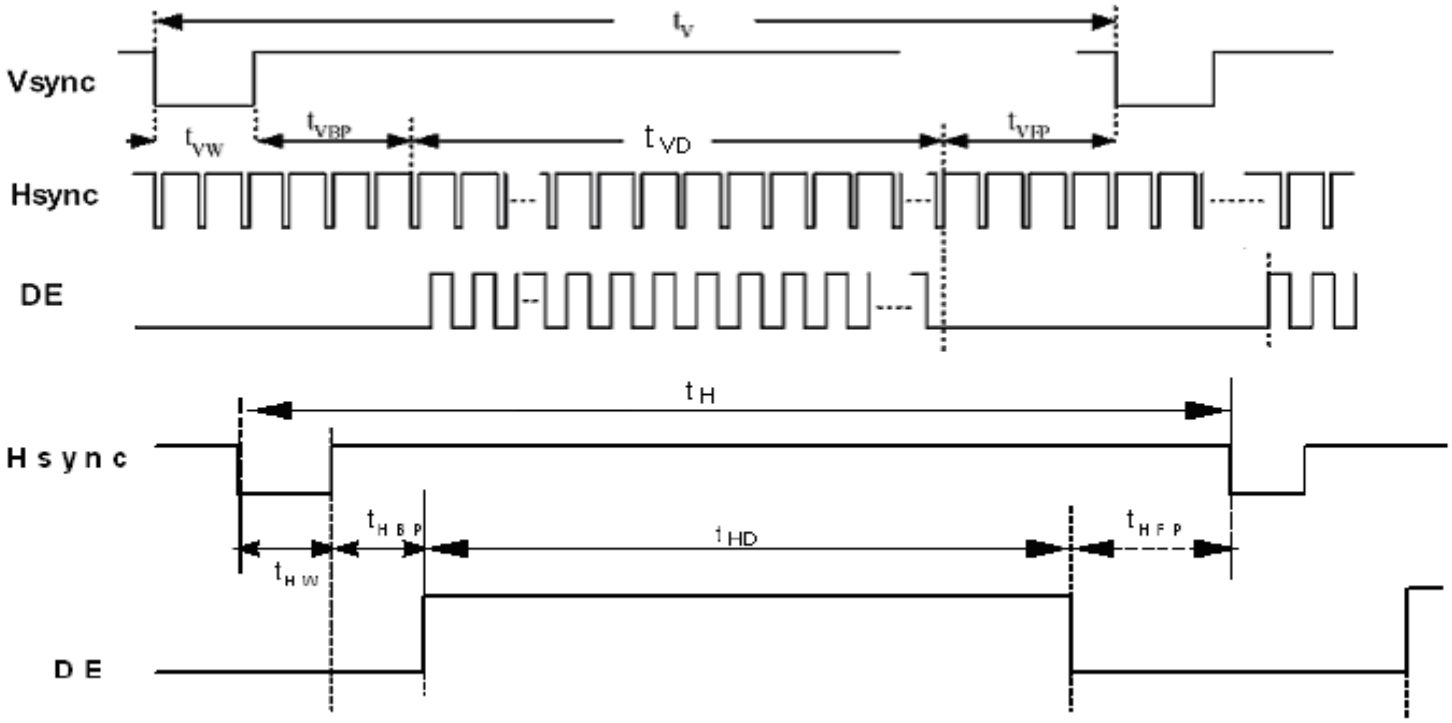
6.1 AC Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Differential input high Threshold voltage	RxVTH	--	--	+100	mV	RXVCM=1.2V
LVDS Differential input low Threshold voltage	RxVTL	-100	--	--	mV	
LVDS Differential input common mode voltage	RxVCM	0.7	--	1.6	V	
LVDDS Differential voltage	|VID|	200	--	600	mV	

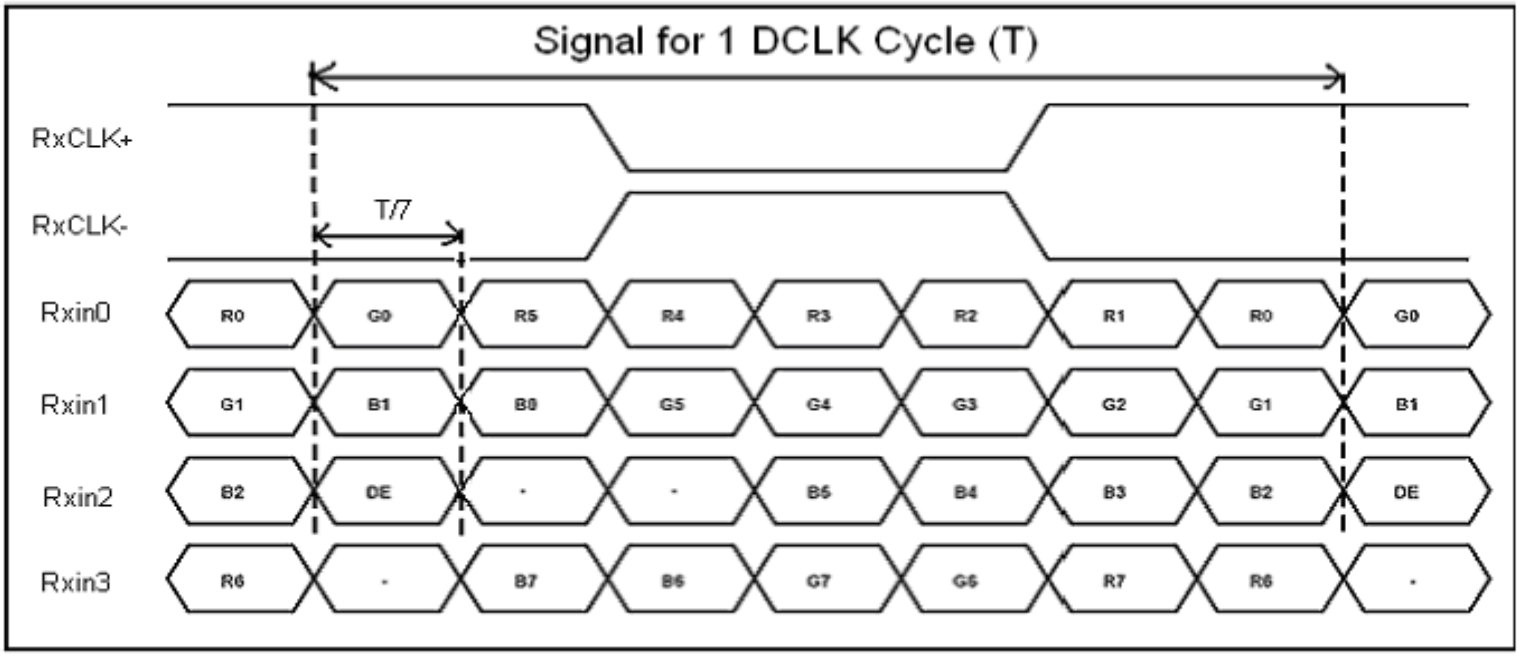


6.2 Timing Table

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock Frequency	1/Tc	16.6	30	35.7	MHZ	Frame rate =60hz
Horizontal display area	THD		480		Tc	
HS period time	TH	440	580	610	TC	
HS Width +Back Porch +Front Porch	THW+THBP +THFP	60	100	130	TC	
Vertical display area	TVD		854		TH	
VS period time	TV	829	877	887	TH	
VS Width +Back Porch +Front Porch	TVW+TVBP +TVFP	15	23	33	TH	



6.3 LVDS Data Input Format



7. CTP Specification

7.1 Electrical Characteristics

7.1.1 Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	2.66	3.47	V	--
Operating temperature	TOP	-20	+70	℃	--
Storage temperature	TST	-30	+80	℃	--
ESD protection voltage (HB Model)	--	--	±2	KV	--

7.1.2 DC Electrical Characteristics (Ta=25℃)

(Ambient temperature:25℃, AVDD=2.8V, VDDIO=1.8V or VDDIO=AVDD)

Item	Min.	Typ.	Max.	Unit	Note
Normal mode operating current	--	8	14.5	mA	
Green mode operating current	--	3.3	--	mA	
Sleep mode operating current	70	--	120	uA	
Doze mode operating current	--	0.78	--	mA	
Digital Input low voltage/VIL	-0.3	--	0.25*VDDIO	V	
Digital Input high voltage/VIH	0.75*VDDIO	--	VDDIO+0.3	V	
Digital Output low voltage/VOL	--		0.15*VDDIO	V	
Digital Output high voltage/VOH	0.85*VDDIO			V	

7.1.3 AC Characteristics

(Ambient temperature:25℃, AVDD=2.8V, VDDIO=1.8V)

Parameter	Min	Type	Max	Unit
OSC oscillation frequency	59	60	61	MHZ
I/O output rise time, low to high	-	14	-	ns
I/O output fall time, high to low	-	14	-	ns

7.2 I2C Timing

The I2C is always configured in the Slave mode. The data transfer format is shown in Figure 2-4.

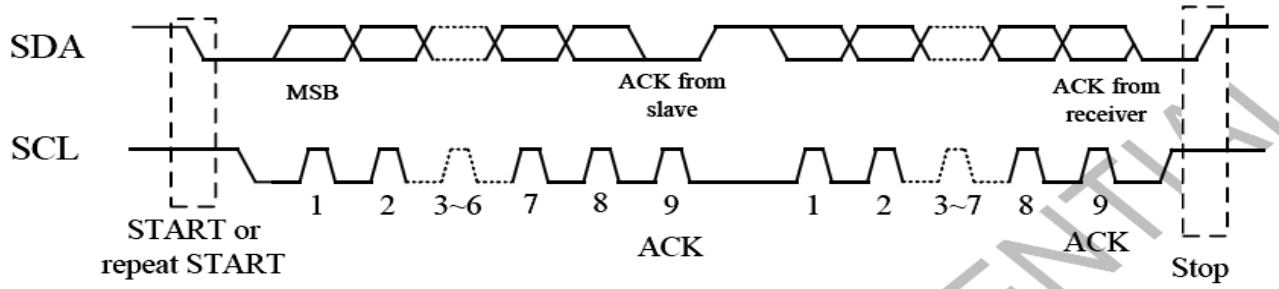


Figure 2-4 I2C Serial Data Transfer Format

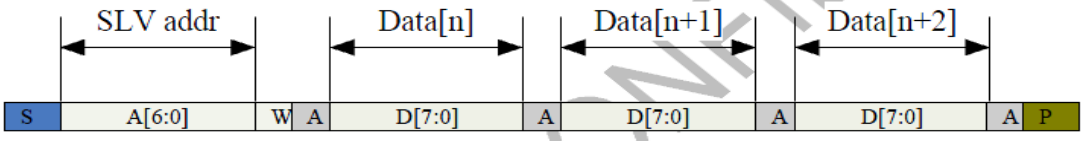


Figure 2-5 I2C master write, slave read

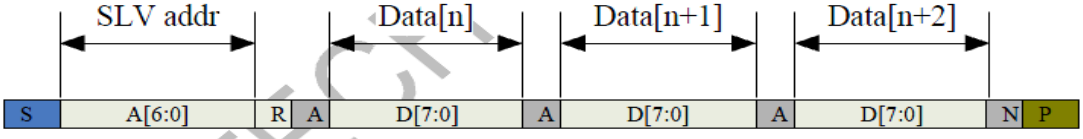


Figure 2-6 I2C master read, slave write

Table 2-1 lists the meanings of the symbols used in the above figures.

Table 2-1 Mnemonics Description

Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address
R/W	READ/WRITE bit, '1' for read, '0' for write
A(N)	ACK(NACK) bit
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

I2C Interface Timing Characteristics is shown in Table 2-2.

Table 2-2 I2C Timing Characteristics

Parameter	Min	Max	Unit
SCL frequency	10	400	KHz
Bus free time between a STOP and START condition	4.7	\	us
Hold time (repeated) START condition	4.0	\	us
Data setup time	250	\	ns
Setup time for a repeated START condition	4.7	\	us
Setup Time for STOP condition	4.0	\	us

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.

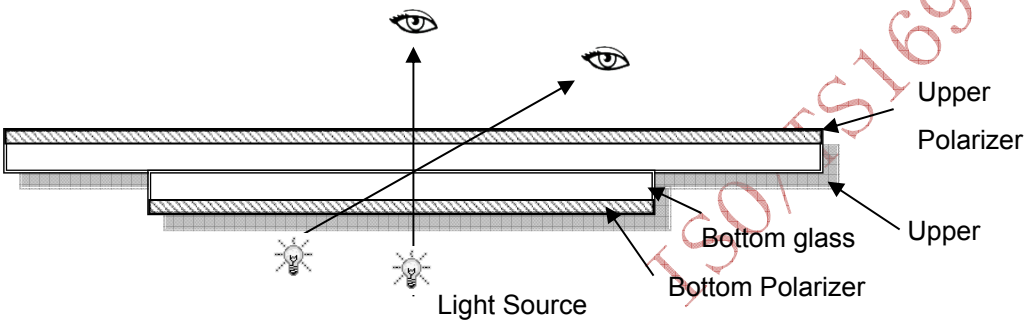
Temperature : 25±5℃

Humidity : 65%±10%RH

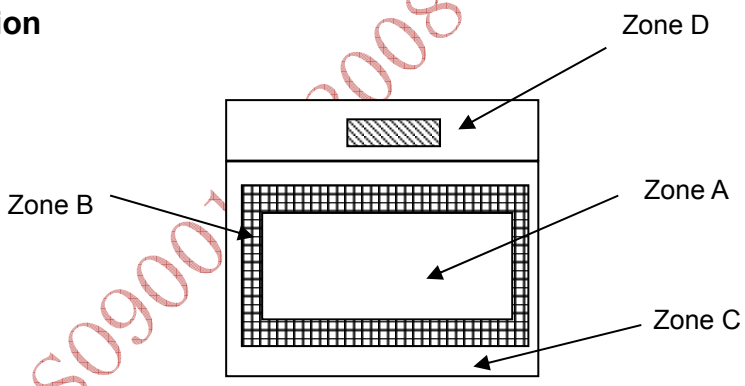
Viewing Angle : Normal viewing Angle.

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 appearance after assembly by customer

8.1.3 Sampling Plan

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

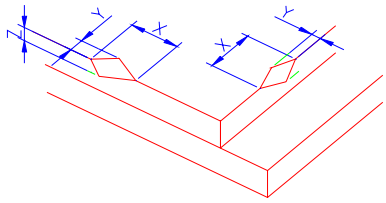
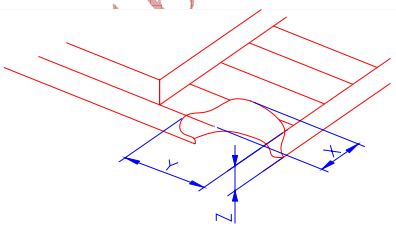
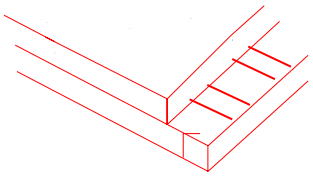
AQL:

Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

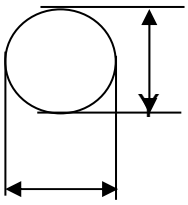
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing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

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



X

Φ=(X+Y)/2

① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.10	Ignore		Ignore
0.10<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.3	2		
Φ>0.35	0		

②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.10<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.3	2		
Φ>0.35	0		

③ Polarizer accidented spot

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

④Pixel bad points（light dot，Dim dot, color dot）

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.15<Φ≤0.25	2(distance≧10mm)		
Φ>0.3	0		

⑤ Polarizer Bubble

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.3<Φ≤0.4	3(distance≧10mm)		
0.5<Φ≤0.6	2		
0.6<Φ	0		

<table>
<tr><td>3.0</td><td>Line defect (LCD/TP /Polarizer backlight black/white line, scratch, stain)</td><td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Length(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></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≤4.0</td><td colspan="2">N≤3</td></tr>
<tr><td>0.07<W≤0.08</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>Electronic Components SMT</td><td>Not allow missing parts, solderless connection, cold solder joint, mis match, The positive and negative polarity opposite</td></tr>
<tr><td>5.0</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 rowspan="2">6.0</td><td rowspan="2">CTP Related</td><td>CTP Cover sensor accidented black/white spot</td><td>
<table>
<tr><td rowspan="2">Size Φ(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.2</td><td colspan="2">3（distance≧10mm）</td></tr>
<tr><td>0.20<Φ≤0.25</td><td colspan="2">2</td></tr>
<tr><td>Φ＞0.3</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td>CTP Cover scratch</td><td>
<table>
<tr><td rowspan="2">Width(mm)</td><td rowspan="2">Ignore(mm)</td><td colspan="3">Acceptable Qty</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤4.0</td><td colspan="3">N≤3</td></tr>
<tr><td>0.07<W≤0.08</td><td>L≤3.0</td><td colspan="3">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td></tr>
</table>

CTP Cover Pinhole/ Lack of ink

Zone / Size (mm)	Acceptable Qty
	C
Φ≤0.1	Ignore
0.1<Φ≤0.2	3(distance≧10mm)
0.25<Φ≤0.3	2
Φ>0.35	0

CTP Bonding bubble/ accidented spot

Size Φ(mm)	Acceptable Qty	
	A	B
Φ≤0.1	Ignore	
0.15<Φ≤0.2	3(distance≧10mm)	
0.2<Φ≤0.25	2	
Φ>0.25	0	

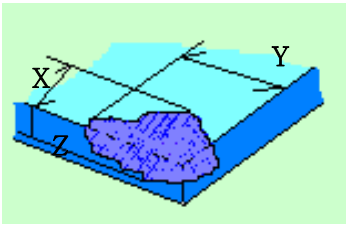
Assembly deflection

beyond the edge of backlight ≤0.2mm

TP cover broken
X：length
Y：width
Z：height

X	Y	Z
X≤0.5mm	Y≤0.5mm	Z<cover thickness

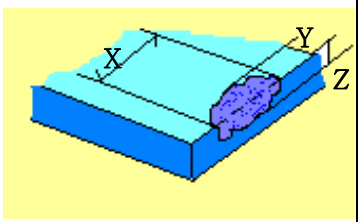
*Circuitry broken is not allowed.



TP cover broken
X：length
Y：width
Z：height

X	Y	Z
X≤0.3mm	Y≤0.3mm	Z<LCD thickness

* Circuitry broken is not allowed.



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	TP no function	Not allowed

9. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	70℃,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	-20℃, 96HR	
High Temperature Storage	80℃, 96HR	
Low Temperature Storage	-30℃, 96HR	
High Temperature & High Humidity Storage	+60℃, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-30℃,30 min ↔ 80℃,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±4KV, 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 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----------