

Display Elektronik GmbH

# DATA SHEET

TFT MODULE

DEM 19201080F VM-PW-N

15,6“ TFT

Product Specification

Version: 0

14.12.2024



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**\* 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 15.6' TFT-LCD contains 1920X1080 pixels, and can display up to 16.7M colors.

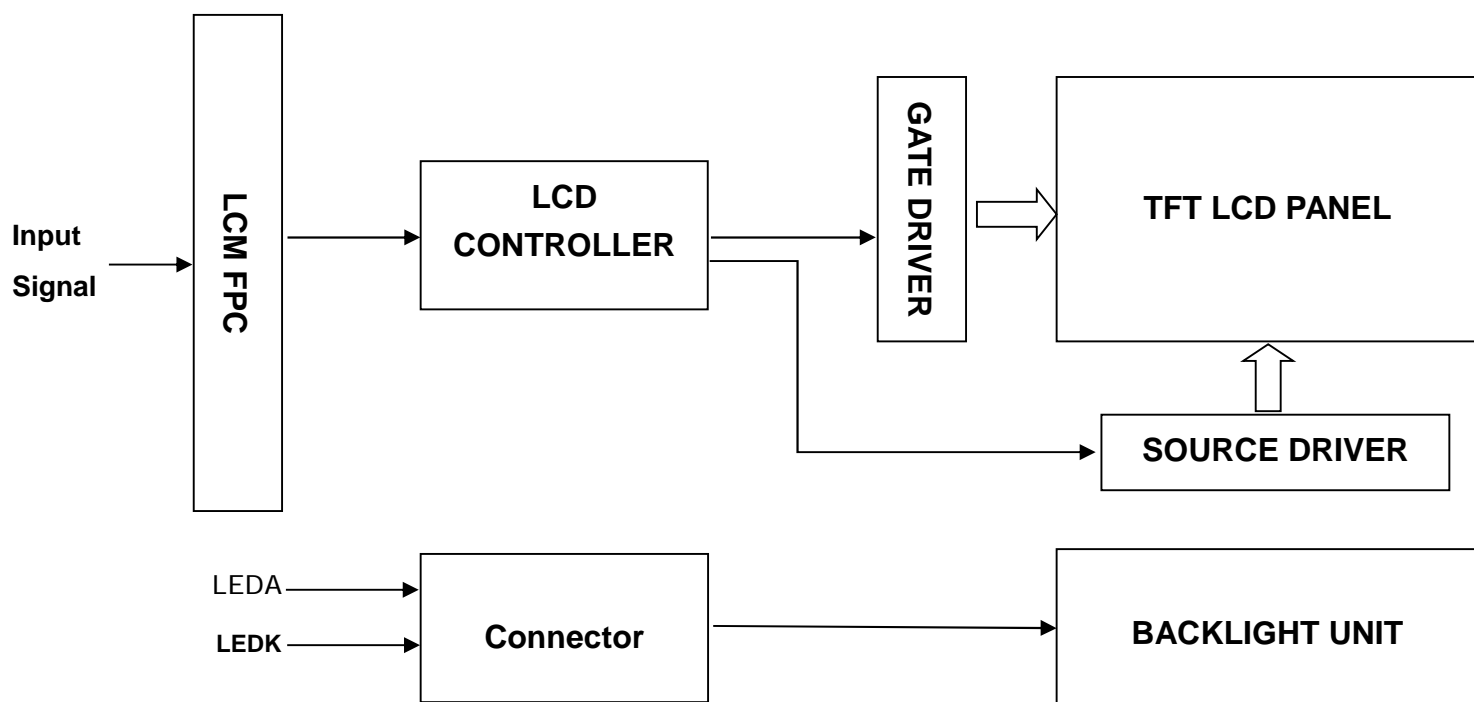
**\* Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	344.16 x 193.59 (15.6inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M	colors	
Number of pixels	1920(RGB)*1080	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.17925(H)*0.17925(V)	mm	
Viewing angle	Supper wide angle	o'clock	
LCM Interface	2-Port LVDS	-	
Display mode	Normally Black	-	
Operating temperature	0~+50	°C	
Storage temperature	-20~+60	°C	

**\* Mechanical Information**

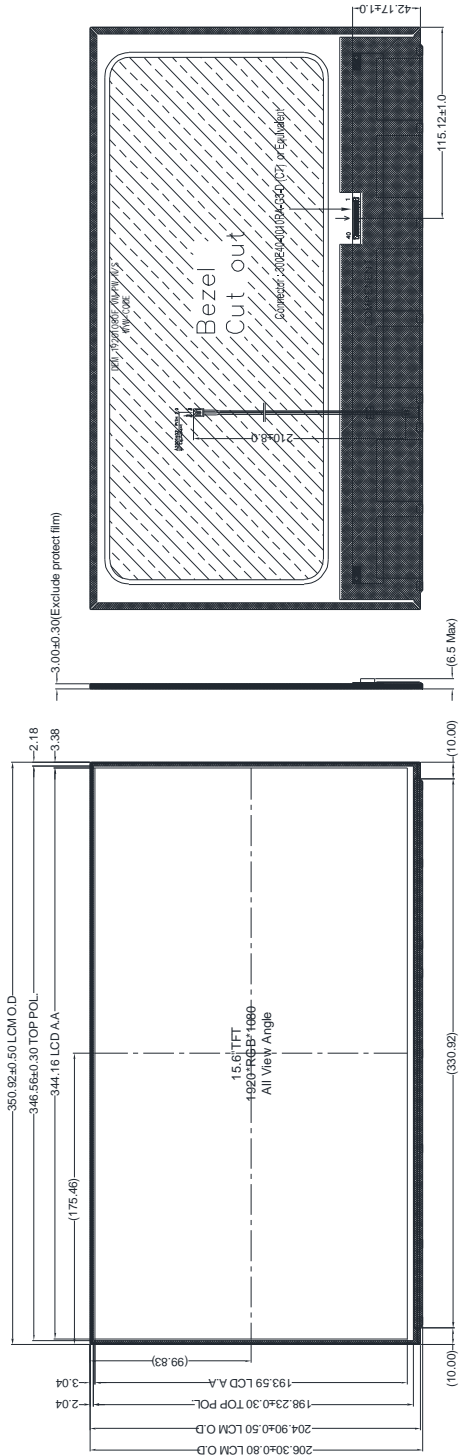
Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	350.92	-	mm	
	Vertical(V)	-	206.30	-	mm	
	Depth(D)	-	3.00	-	mm	
Weight		-	TBD	-	g	

1. Block Diagram



2. Outline dimension

Pin	Name
1	RxO0-
2	RxO0+
3	RxO1-
4	RxO1+
5	RxO2-
6	RxO2+
7	GND
8	RxOCLK-
9	RxOCLK+
10	GND
11	RxO3-
12	RxO3+
13	GND
14	RxI0-
15	RxI0+
16	RxI1-
17	RxI1+
18	RxI2-
19	RxI2+
20	GND
21	RxECLK-
22	RxECLK+
23	GND
24	RxE3-
25	RxE3+
26	GND
27	LCD_VCC
28	LCD_VCC
29	BIST
30	NC
31	NC
32	NC
33	NC
34	NC
35	NC
36	GND
37	GND
38	GND
39	ID1
40	ID2



- NOTES:
1. DISPLAY TYPE: 15.6", TFT LCD, 16.7M COLORS
  2. DISPLAY MODE: NORMALLY BLACK, IPS
  3. VIEWING DIRECTION: FREE
  4. LCM DRIVER IC: \*\*\*\*\* (COG)
  5. TFT INTERFACE: 2 Port LVDS
  6. TOUCH MODE: NA
  7. TOUCH DRIVER: NA
  8. CTP INTERFACE: NA
  9. TOUCH AND LCM BONDING TECHNOLOGY: NA
  10. LCD VCC: 12V
  11. OPERATING TEMP: 0°C TO 50°C  
STORAGE TEMP: -20°C TO 60°C
  12. BACK LIGHT: LED WHITE, 54 LED, 180mA (Typ.), 3.6V (Typ.)
  13. RoHS AND REACH COMPLIANT.

**3. Input terminal Pin Assignment****Connector:300E40-0010RA-G3-D(CT) or equivalent**

NO.	SYMBOL	DISCRIPTION	I/O
1	RX00-	Negatige LVDS differential data input(Odd data)	I
2	RX00+	Positive LVDS differential data input(Odd data)	I
3	RX01-	Negatige LVDS differential data input(Odd data)	I
4	RX01+	Positive LVDS differential data input(Odd data)	I
5	RX02-	Negatige LVDS differential data input(Odd data)	I
6	RX02+	Positive LVDS differential data input(Odd data)	I
7	GND	Ground	P
8	RXOCLK-	Negatige LVDS differential clock input(Odd data)	I
9	RXOCLK+	Positive LVDS differential clock input(Odd data)	I
10	GND	Ground	P
11	RX03-	Negatige LVDS differential data input(Odd data)	I
12	RX03+	Positive LVDS differential data input(Odd data)	I
13	GND	Ground	P
14	RXE0-	Negatige LVDS differential data input(Even data)	I
15	RXE0+	Positive LVDS differential data input(Even data)	I
16	RXE1-	Negatige LVDS differential data input(Even data)	I
17	RXE1+	Positive LVDS differential data input(Even data)	I
18	RXE2-	Negatige LVDS differential data input(Even data)	I
19	RXE2+	Positive LVDS differential data input(Even data)	I
20	GND	Ground	P
21	RXECLK-	Negatige LVDS differential clock input(Even data)	I
22	RXECLK+	Positive LVDS differential clock input(Even data)	I
23	GND	Ground	P
24	RXE3-	Negatige LVDS differential data input(Even data)	I
25	RXE3+	Positive LVDS differential data input(Even data)	I
26	GND	Ground	P
27	LCD_VCC	LCD VCC(12V)	P

28	LCD_VCC	LCD VCC(12V)	P
29	BIST	LCD Self-test Nomal mode:NC or pull L BIST mode:pull H	I
30	NC	No Connection	--
31	NC	No Connection	--
32	NC	No Connection	--
33	NC	No Connection	--
34	NC	No Connection	--
35	NC	No Connection	--
36	GND	Ground	P
37	GND	Ground	P
38	GND	Ground	P
39	ID1	Pull High	I
40	ID2	Pull High	I



## 4. LCD Optical Characteristics

### 4.1 Optical specification

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.	Note	
Contrast Ratio	CR	$\Theta=0$	--	3000	--		(1)(2)	
Response time	Rising	$T_R$	Normal viewing angle	--	30	35	msec	(1)(3)
	Falling	$T_F$		--	30	35		
Color Gamut	S(%)		38	72	--	%		
Color Filter Chromaticity	White	$W_X$	-0.04	0.313	+0.04		(1)(4) CA310	
		$W_Y$		0.329				
	Red	$R_X$		0.650				
		$R_Y$		0.338				
	Green	$G_X$		0.312				
		$G_Y$		0.615				
	Blue	$B_X$		0.150				
		$B_Y$		0.071				
Viewing angle	Hor.	$\Theta_L$	CR>10	80	89	--		
		$\Theta_R$		80	89	--		
	Ver.	$\Theta_U$		80	89	--		
		$\Theta_D$		80	89	--		
Option View Direction	ALL							

\*The data comes from the LCD specification.

#### Measuring Condition

Measuring surrounding : dark room

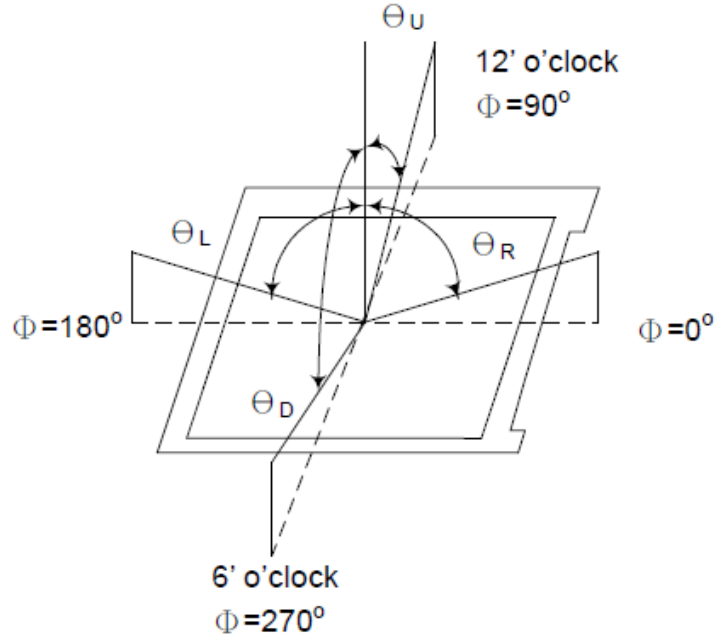
Ambient temperature :  $25 \pm 2^\circ\text{C}$

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.

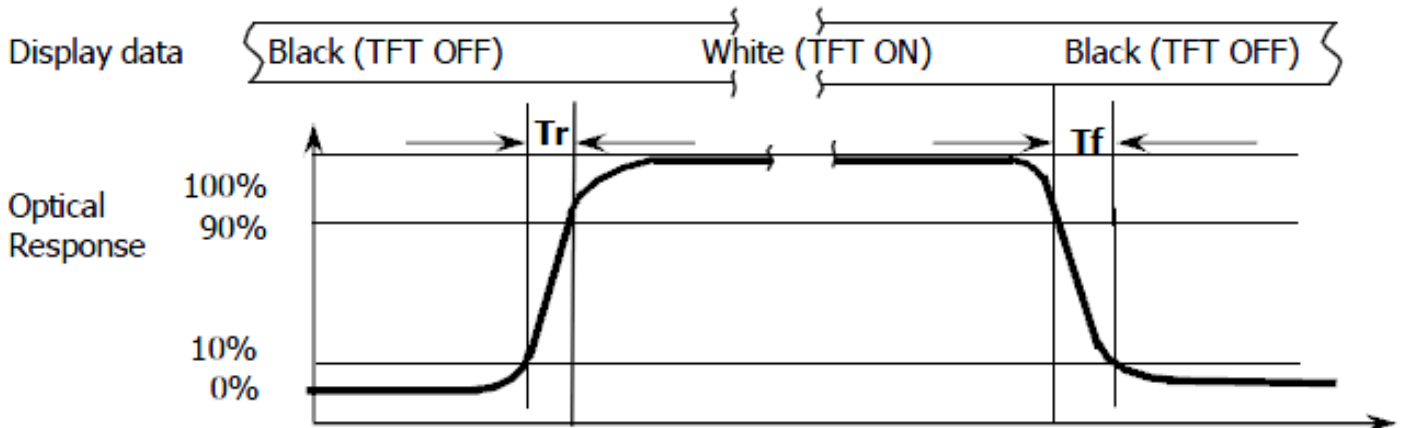
Note (1): Definition of Viewing Angle :



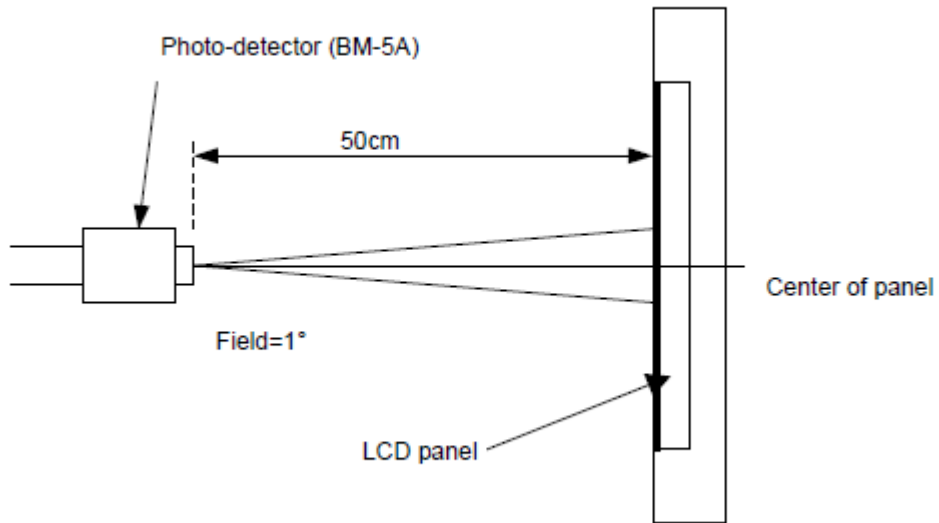
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

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

Note (3): Response Time



**Note (4):** Definition of optical measurement setup



## 5. Electrical Characteristics

### 5.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	LCD_VCC	-0.3	13.2	V	Note1
Input Signal Voltage	V <sub>IN</sub>	-0.3	3.6	V	
Operating temperature	T <sub>OP</sub>	0	+50	°C	
Storage temperature	T <sub>ST</sub>	-20	+60	°C	

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.

### 5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	LCD_VCC	10.8	12	13.2	V	
Normal mode Current	I <sub>DD</sub>	--	200	--	mA	
Level input voltage	V <sub>IH</sub>	0.7LCD_VCC		LCD_VCC	V	
	V <sub>IL</sub>	GND		0.3 LCD_VCC	V	
Level output voltage	V <sub>OH</sub>	LCD_VCC-		--	V	
	V <sub>OL</sub>	GND		GND+0.4	V	

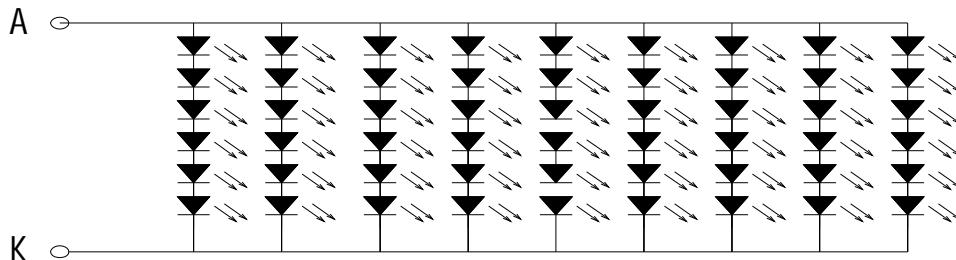
5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 54 chips LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I <sub>F</sub>	--	180	--	mA	
Forward Voltage	V <sub>F</sub>	--	36	--	V	
LCM Luminance	LV	400	450	--	cd/m <sup>2</sup>	IF=160mA
LED life time	Hr	--	30000	--	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 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

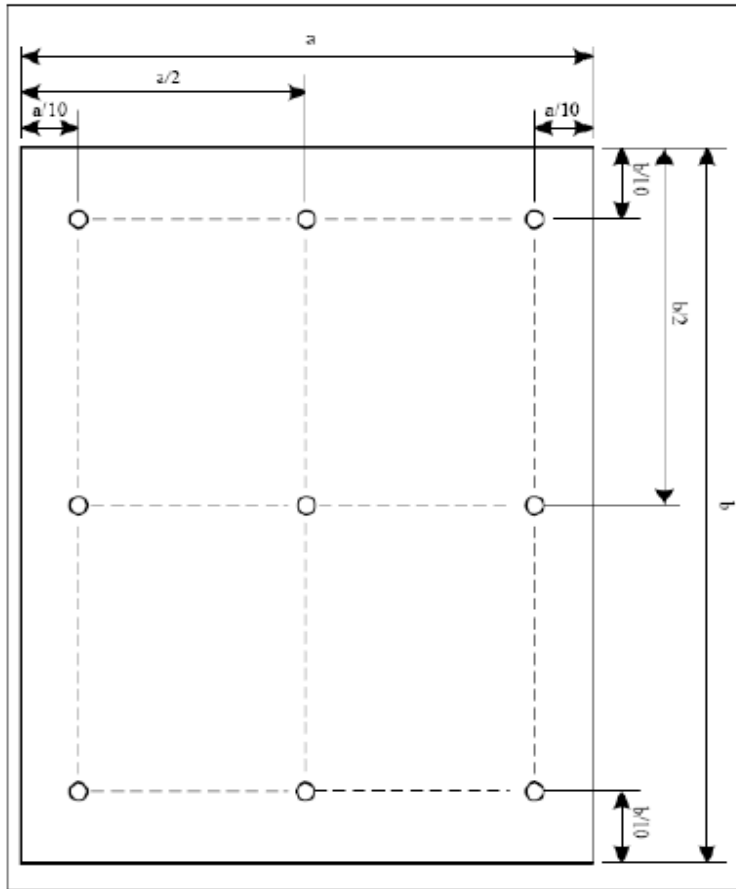
Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C and IL=180mA. The LED lifetime could be decreased if operating IL is larger than 180mA. The constant current driving method is suggested.



Backlight LED 6 \* 9 = 54EA Circuit

LED (B/L) CIRCUIT

Note (5) Luminance Uniformity of these 9 points is defined as below:



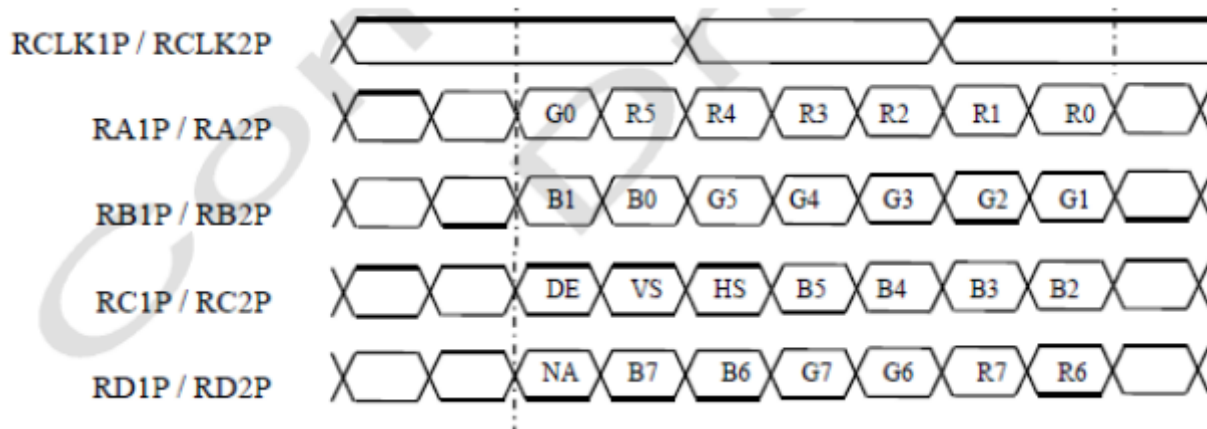
$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

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

## 6. LVDS Characteristics

### 6.1 LVDS Interface

#### 6.1.1 VESA Format



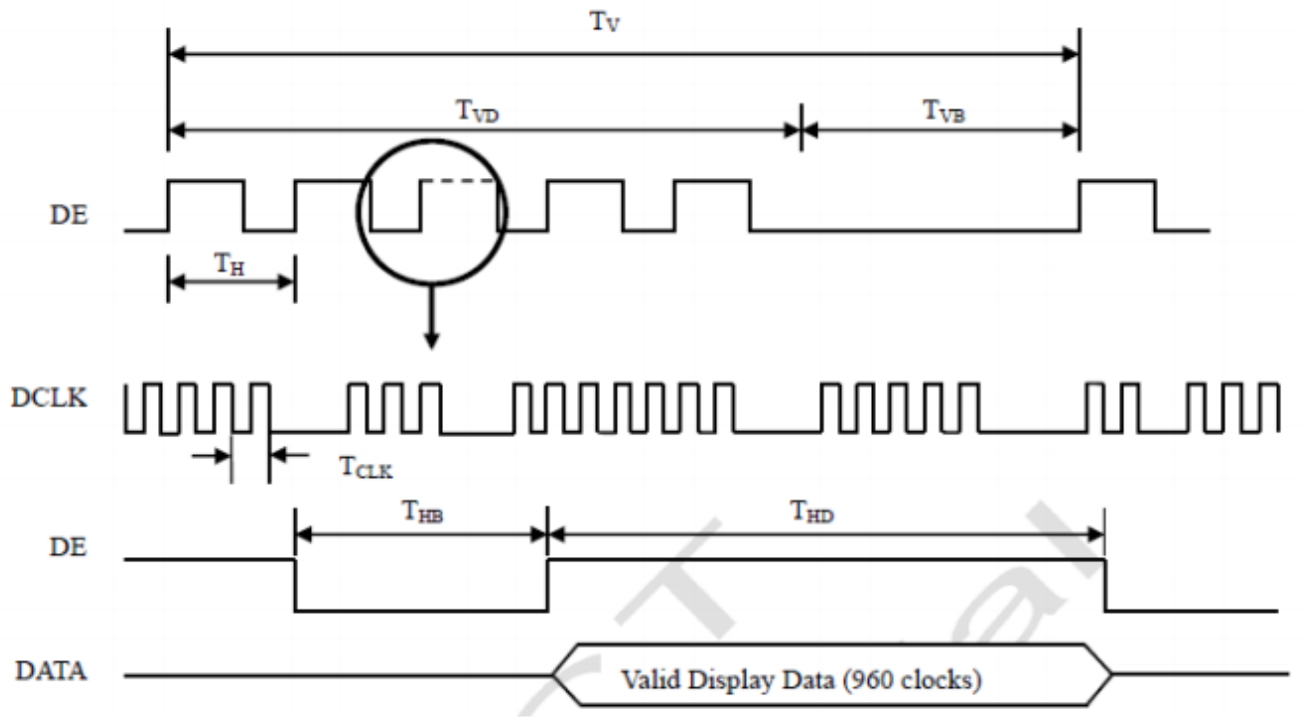
6.2 Interface Timing

6.2 .1 Timing Table(DE Only Mode)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Receiver Clock	Frequency	Fclk (=1/TClk)	59.4	74.25	77.34	MHz	(1) (2)
	Input cycle to cycle jitter	Trcl	-	-	200	ps	(3)
	Spread spectrum modulation range	Fclk_mod	Fclk-2%	-	Fclk+2%	MHz	(4)
	Spread spectrum modulation frequency	FSSM	60	-	200	KHz	
LVDS Receiver Data	Receiver Skew Margin	TRSM	-400	-	400	ps	(5)
Vertical Active Display Term	Frame Rate	F	48	60	62.5	Hz	
	Total	TV	1092	1125	1380	TH	TV = TVD +TVB
	Display	TVD	1080				
	Blank	TVB	12	45	300	TH	
Horizontal Active Display Term	Total	TH	1046	1100	1174	TCLK	TH = THD + THB
	Display	THD	960				960=1920/2port
	Blank	THB	86	140	214	TCLK	

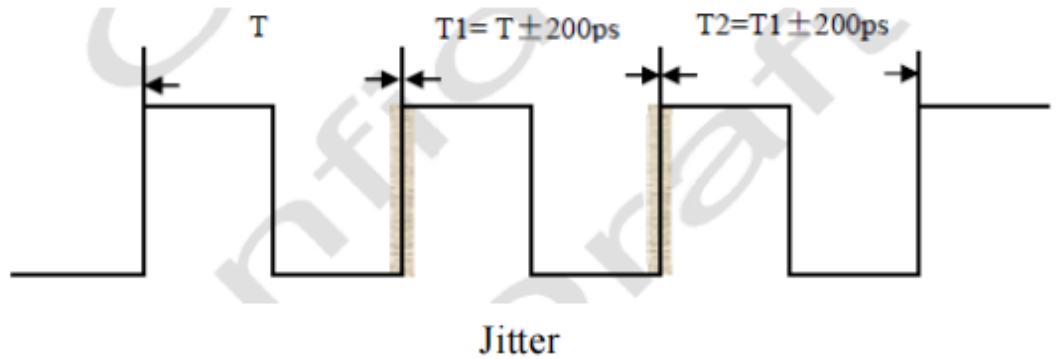
- Note:
- (1) The TFT LCD open cell is operated in DE only mode, H sync and V sync input signal have no effect normal operation.
  - (2) Please make sure the range of pixel clock follows the following equations:  
 $F_{clk(max)} \geq F_{max} \times T_v \times T_h$   $F_{min} \times T_v \times T_h \geq F_{clk(min)}$  74.25MHZ=148.5/2port LVDS



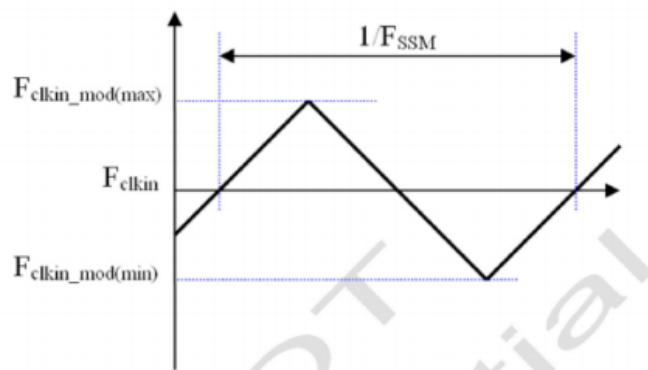


Interface signal timing diagram

(3)The input clock cycle-to-cycle is defined as below figures.

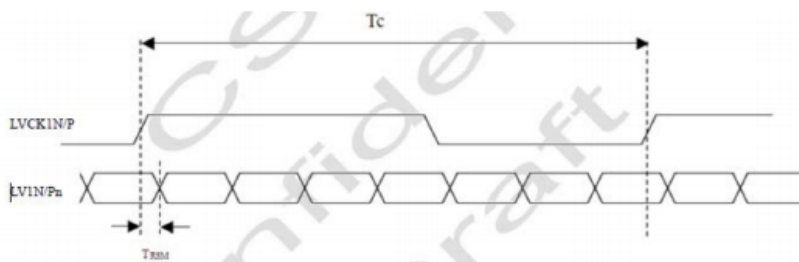


(4) The SSCG (Spread Spectrum Clock Generator) is defined as the following figure. The LVDS SSCG 's suggestion is off by default, SOC board must test all validation if SOC board open LVDS SSM.



SSM

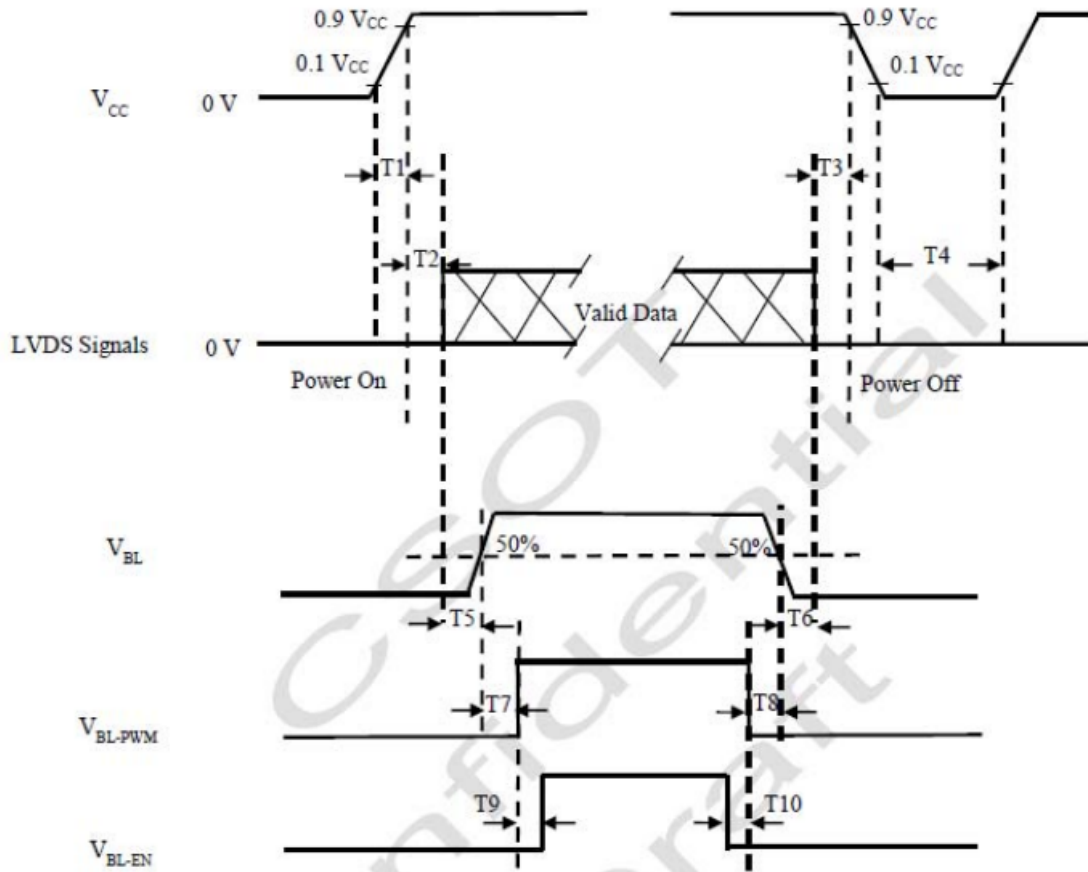
(5) The LVDS timing diagram and setup/hold time is defined and showed as the following figure.



LVDS receive interface timing diagram

### 6.3 Power On/Off Sequence

To prevent a latch-up or DC operation of the Open cell, the power on/off sequence should be as diagram below.



## Power on/off sequence

Parameter	Values			Unit	Note
	Min.	Typ.	Max.		
T1	0.5	-	10.0	ms	
T2	0.0	50	200	ms	
T3	0.0	50	200	ms	
T4	1000.0	-	-	ms	
T5	500.0	-	-	ms	
T6	100.0	-	-	ms	
T7	0	-	-	ms	
T8	0	-	-	ms	
T9	0	-	-	ms	
T10	0	-	-	ms	

## Attention:

- (1) The supply voltage of the external system for the open cell input should follow the definition of VCC
- (2) When the customer's backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.
- (3) In case that VCC is in off level, please keep the level of input signals on the low or high impedance.  $T2 < 0$ , that may cause electrical overstress.
- (4) T4 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

### 7. LCD Module Out-Going Quality Level

#### 7.1 VISUAL & FUNCTION INSPECTION STANDARD

##### 7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

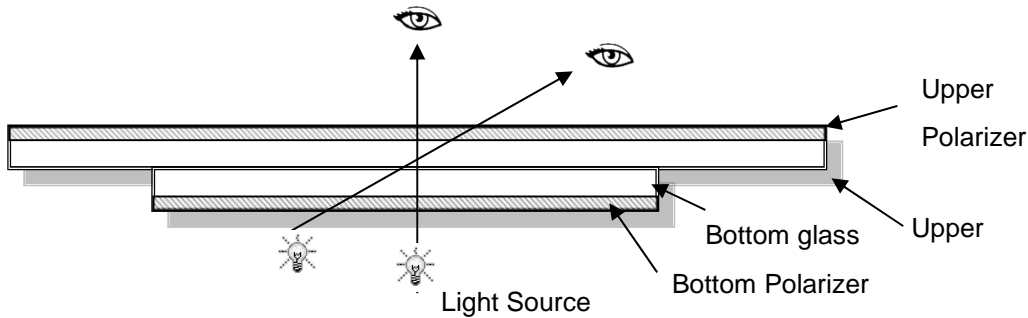
Temperature : 25±5°C

Humidity : 65%±10%RH

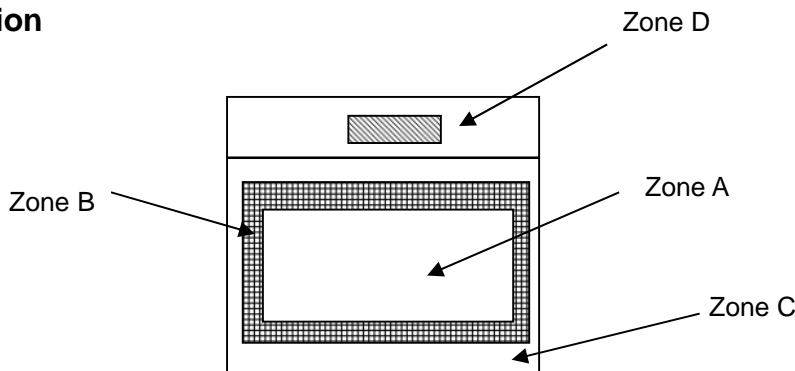
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



##### 7.1.2 Definition



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

Zone B : Viewing Area except Zone A

Zone C : Outside (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

## 7.1.3 Sampling Plan

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

AQL:

Major defect	Minor defect
0.65	1.5

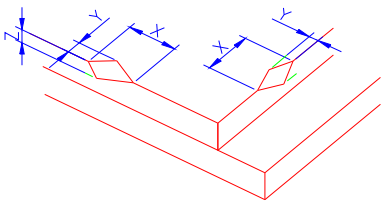
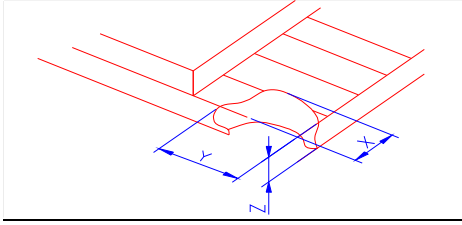
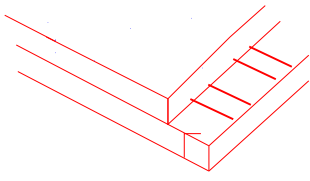
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module

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.

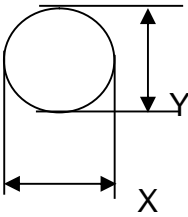
b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

7.1.4 Criteria (Visual)

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

2.0

Spot defect



$$\Phi = (X + Y) / 2$$

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

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.15 < \Phi \leq 0.25$	3(distance $\geq 10$ mm)		
$0.25 < \Phi \leq 0.4$	2(distance $\geq 10$ mm)		
$\Phi > 0.4$	0		

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

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.15 < \Phi \leq 0.25$	3( distance $\geq 10$ mm)		
$0.25 < \Phi \leq 0.4$	2( distance $\geq 10$ mm)		
$\Phi > 0.4$	0		



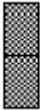
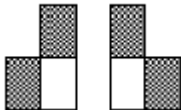
③ Polarizer accidented spot


Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.5$	2( distance $\geq 10$ mm)		
$\Phi > 0.5$	0		

④ Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.2 < \Phi \leq 0.4$	2(distance $\geq 10$ mm)		
$\Phi > 0.4$	0		



3.0	LCD Pixel defect	<p>Pixel bad points</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Zone A</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td rowspan="3">Bright dot</td> <td>Random</td> <td>N≤2</td> </tr> <tr> <td>2 dots adjacent</td> <td>N≤0</td> </tr> <tr> <td>3 dots adjacent</td> <td>N≤0</td> </tr> <tr> <td rowspan="3">Dark dot</td> <td>Random</td> <td>N≤3</td> </tr> <tr> <td>2 dots adjacent</td> <td>N≤0</td> </tr> <tr> <td>3 dots adjacent</td> <td>N≤0</td> </tr> <tr> <td>Distance</td> <td>                     1. Minimum Distance Between Bright dots.                      2. Minimum Distance Between dark dots                      3. Minimum Distance Between dark and bright dot.                 </td> <td>5mm</td> </tr> <tr> <td colspan="2">Total bright and dark dot</td> <td>N≤4</td> </tr> </tbody> </table> <p>Note:</p> <p>A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p>B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p>C) 2 dot adjacent = 1 pair = 2 dots</p> <p>Picture:</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>2 dot adjacent</p> </div> <div style="text-align: center;">  <p>2 dot adjacent</p> </div> <div style="text-align: center;">  <p>2 dot adjacent (vertical)</p> </div> <div style="text-align: center;">  <p>2 dot adjacent (slant)</p> </div> </div>	Item	Zone A	Acceptable Qty	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
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4.0	Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length  N : Count	<table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(m m)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.05</math></td> <td>Ignore</td> <td colspan="3">Ignore</td> </tr> <tr> <td><math>0.05 &lt; W \leq 0.06</math></td> <td><math>L \leq 5.0</math></td> <td colspan="3"><math>N \leq 3</math></td> </tr> <tr> <td><math>0.06 &lt; W \leq 0.08</math></td> <td><math>L \leq 4.0</math></td> <td colspan="3"><math>N \leq 2</math></td> </tr> <tr> <td><math>W &gt; 0.08</math></td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table>	Width(mm)	Length(m m)	Acceptable Qty			A	B	C	$\Phi \leq 0.05$	Ignore	Ignore			$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$			$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$			$W > 0.08$	Define as spot defect			
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$W > 0.08$	Define as spot defect																													
5.0	Electronic Components SMT.	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite																												
6.0	Display color & Brightness.	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.																												
7.0	LCD Mura/Waving/ Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.																												

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

## 8. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	50°C,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	0°C, 96HR	
High Temperature Storage	60°C, 96HR	
Low Temperature Storage	-20°C, 96HR	
High Temperature & High Humidity Operating	60°C, 80% RH ,96hours.	
Thermal Shock (Non-operation)	-20°C,30 min ↔ +60°C,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±15KV, 5times; Contact:±8KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~500Hz, Stroke:1.5mm Sweep:10Hz~500Hz~10Hz 1 hours for each direction of X.Y.Z. (1 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm(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.

## **9. Cautions and Handling Precautions**

### **9.1 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.

### **9.2 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 °C 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.