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Optical Bonding

Cover glass

System solutions

OEM Solutions

Custom Display

Production
Custom designs
Installation

Mechanical design



SPECIFICATION FOR LCM Module

MODULE No:	ET170SX20-K
CUSTOMER:	

YOURITECH	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		



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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 17.0" TFT-LCD contains 1280X1024 pixels, and can display up to 16.7M colors.

* Features

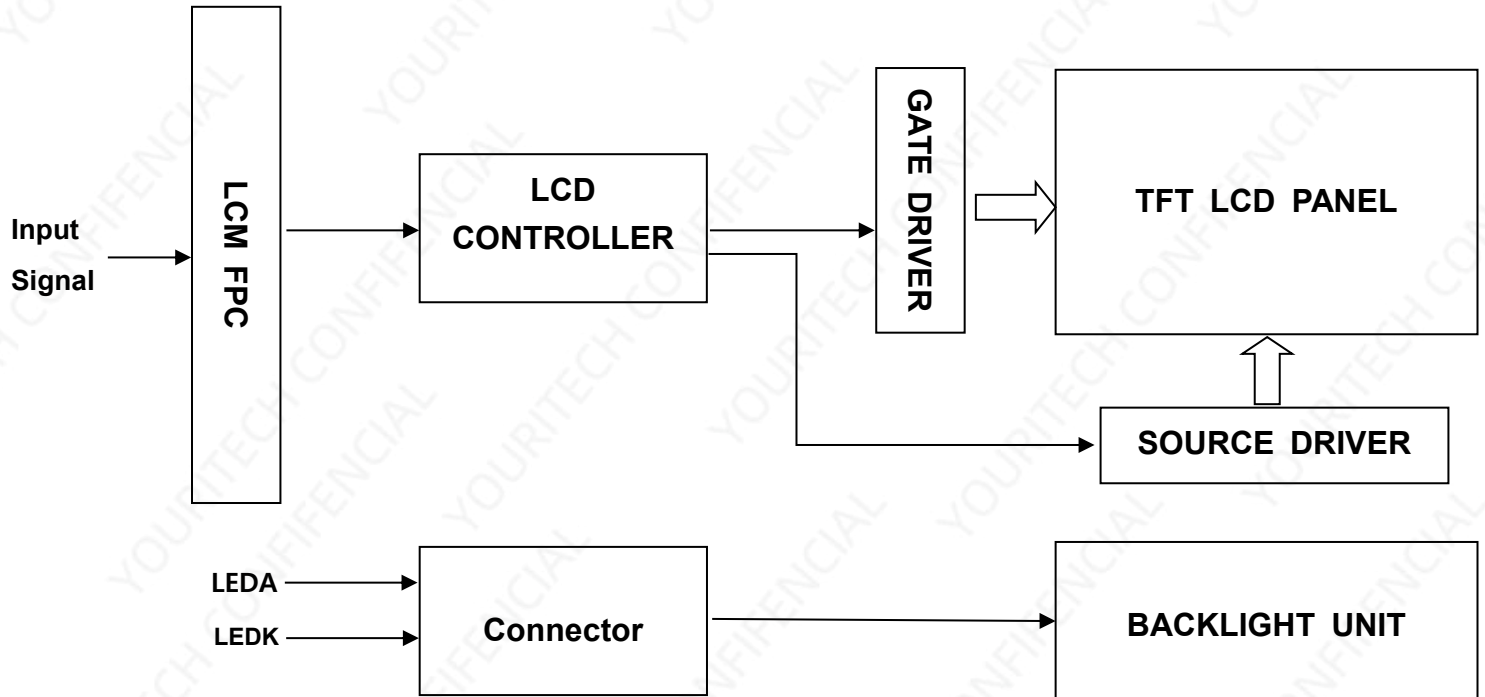
General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	337.92(H)*270.336(V) (17.0 inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M	colors	
Number of pixels	1280(RGB)*1024	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.264(H)*0.264(V)	mm	
Viewing angle	6:00	o'clock	
LCM Interface	2-Port LVDS	-	
Display mode	Normally White	-	
Operating temperature	-30~+85	°C	
Storage temperature	-30~+85	°C	

* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	358.50	-	mm	
	Vertical(V)	-	296.50	-	mm	
	Depth(D)	-	10.50	-	mm	
Weight		-	1029	-	g	



1. Block Diagram





3. Input terminal Pin Assignment

3.1 TFT PIN

Connector(CN1):MDF76URW-30S-1H(55)

NO.	SYMBOL	DISCRIPTION	I/O
1	RxO0-	Odd LVDS Negative data signal (-)	I
2	RxO0+	Odd LVDS Positive data signal (+)	I
3	RxO1-	Odd LVDS Negative data signal (-)	I
4	RxO1+	Odd LVDS Positive data signal (+)	I
5	RxO2-	Odd LVDS Negative data signal (-)	I
6	RxO2+	Odd LVDS Positive data signal (+)	I
7	GND	Ground	P
8	RxOCLK-	Odd LVDS Negative CLK signal (-)	I
9	RxOCLK+	Odd LVDS Positive CLK signal (+)	I
10	RxO3-	Odd LVDS Negative data signal (-)	I
11	RxO3+	Odd LVDS Positive data signal (+)	I
12	RxE0-	EVEN LVDS Negative data signal (-)	I
13	RxE0+	EVEN LVDS Positive data signal (+)	I
14	GND	Ground	P
15	RxE1-	EVEN LVDS Negative data signal (-)	I
16	RxE1+	EVEN LVDS Positive data signal (+)	I
17	GND	Ground	P
18	RxE2-	EVEN LVDS Negative data signal (-)	I
19	RxE2+	EVEN LVDS Positive data signal (+)	I
20	RxECLK-	EVEN LVDS Negative CLK signal (-)	I
21	RxECLK+	EVEN LVDS Positive CLK signal (+)	I
22	RxE3-	EVEN LVDS Negative data signal (-)	I
23	RxE3+	EVEN LVDS Positive data signal (+)	I
24	GND	Ground	P



25	GND	Power Ground	P
26	GND	Power Ground	P
27	GND	Power Ground	P
28	VDD	Power supply:+5V	P
29	VDD	Power supply:+5V	P
30	VDD	Power supply:+5V	P

3.2 BL PIN(PH2.0*2P)

2-pin connector is used for input power & control signals for BL converter power IC

NO.	SYMBOL	DISCRIPTION	I/O
1	LEDA	LED power supply	P
2	LEDK	LED current sense for string	P



4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	$\Theta=0$ Normal viewing angle	800	1200	--		(1)(2)
Response time	Rising	T_R+T_F		--	20	--	msec	(1)(3)
	Falling			--				
Color Gamut		S(%)		--	72.30	--	%	
Color Filter Chromaticity	White	W_X	-0.04	$+0.04$	0.2925		(1)(4) CA31 0	
		W_Y			0.2980			
	Red	R_X			0.6413			
		R_Y			0.3489			
	Green	G_X			0.3060			
		G_Y			0.6062			
	Blue	B_X			0.1483			
		B_Y			0.0450			
Viewing angle	Hor.	Θ_L	CR>10	70	85	--		
		Θ_R		70	85	--		
	Ver.	Θ_U		50	70	--		
		Θ_D		60	70	--		
Option View Direction		6:00						

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark room

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

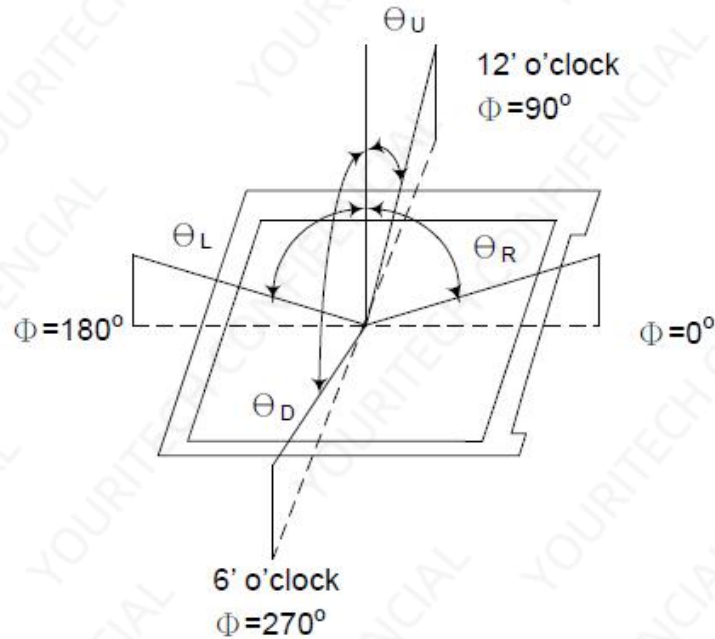
15min. warm-up time.

Measuring Equipment

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



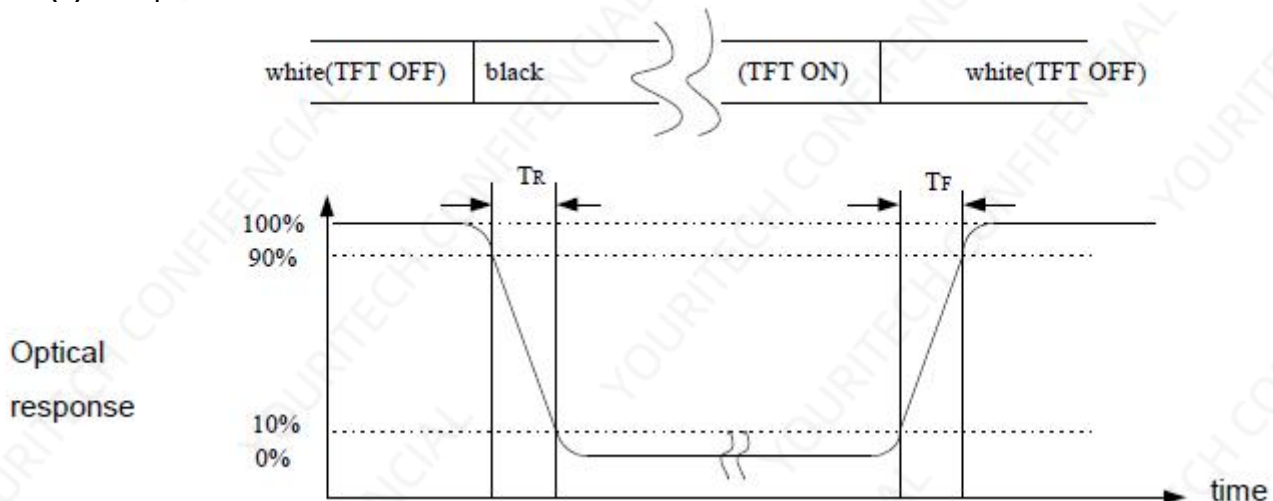
Note (1): Definition of Viewing Angle :



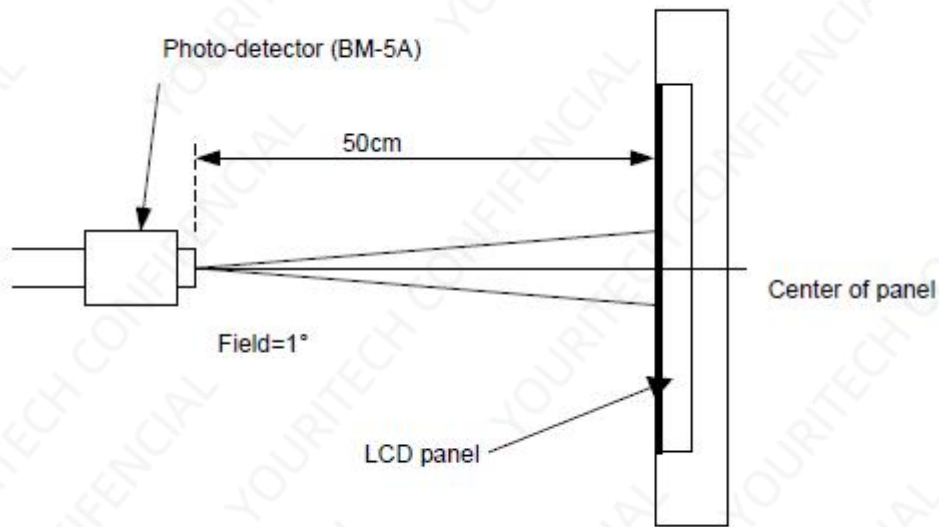
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

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

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	VDD	-0.3	6.0	V	
Operating temperature	T _{OP}	-30	+85	°C	
Storage temperature	T _{ST}	-30	+85	°C	

NOTE:

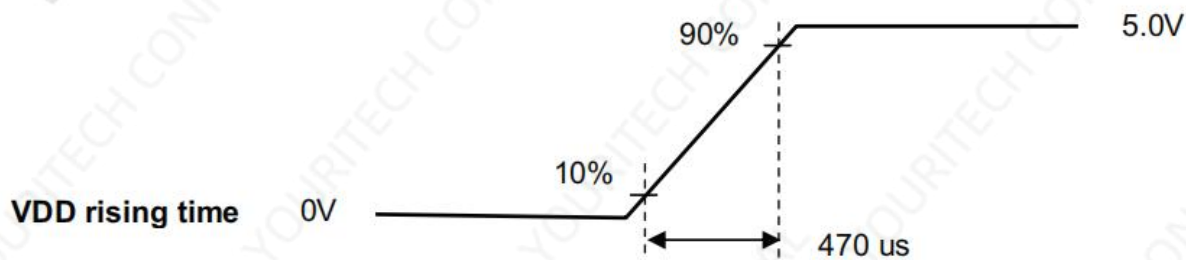
- 1.All of the voltages listed above are with respective to GND=0V
- 2.Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	VDD	4.5	5	5.5	V	
Power Supply Current	IDD	--	800	1000	mA	
Rush Current	IRUSH	--	--	2.5	A	
VDD Power	PDD	--	4	4.5	W	
Allowable Logic/LCD Drive Ripple Voltage	VDDrp	--	--	200	mV	



The diagram illustrates a circuit for generating a High to Low Control Signal. It features a 5V supply connected to a 47K resistor (R1) and a 1K resistor (R2). A switch (SW1, SW MAG-SPST) is connected to the 5V supply and the 1K resistor. The other end of the 1K resistor is connected to the gate of an N-channel MOSFET (Q3, AO6402). The drain of Q3 is connected to a 5V supply through a 47K resistor (R1) and to the LCD module input (VDD) through a 1K resistor (R2). The source of Q3 is connected to ground through a 47K resistor (VR1) and a 0.01uF/25V capacitor (C3). A 1uF/15V capacitor (C1) is connected between the VDD line and ground. The LCD module input is labeled (LCD Module Input).



5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 40 Dual chips LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	--	300	--	mA	
Forward Voltage	V_F	56	57.8	60	V	
LCM Luminance	LV	1300	1400	--	cd/m2	$I_F=300\text{mA}$
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:

$T_a=25\pm3\text{ }^{\circ}\text{C}$, 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

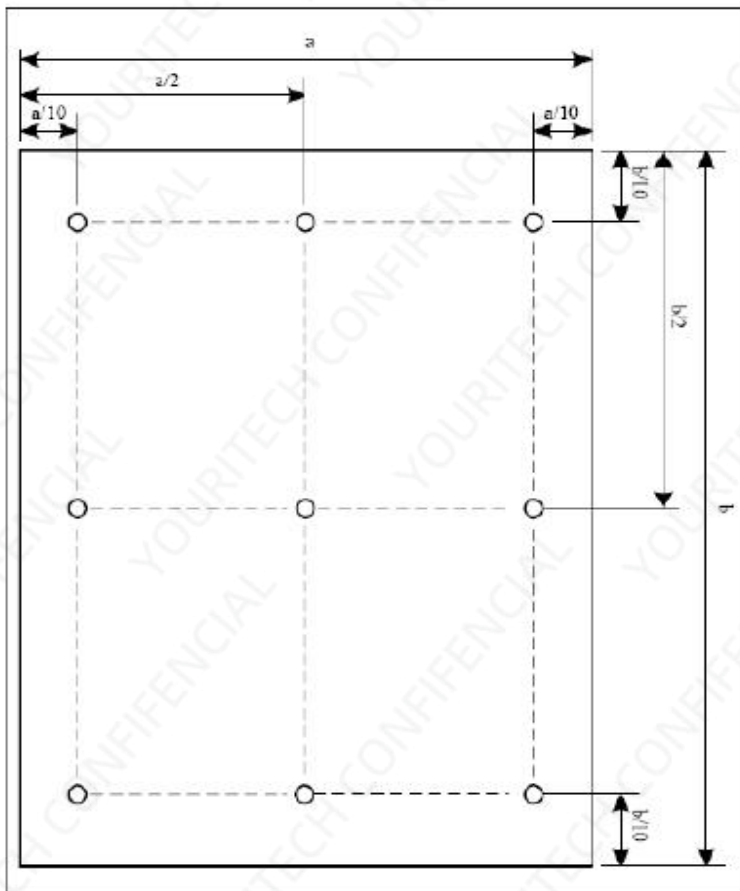
$T_a=25^{\circ}\text{C}$ and $I_L=300\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 300mA. The constant current driving method is suggested.



Backlight LED $10 \times 4 = 40$ EA * 2 groups Circuit
LED (B/L) CIRCUIT



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



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

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

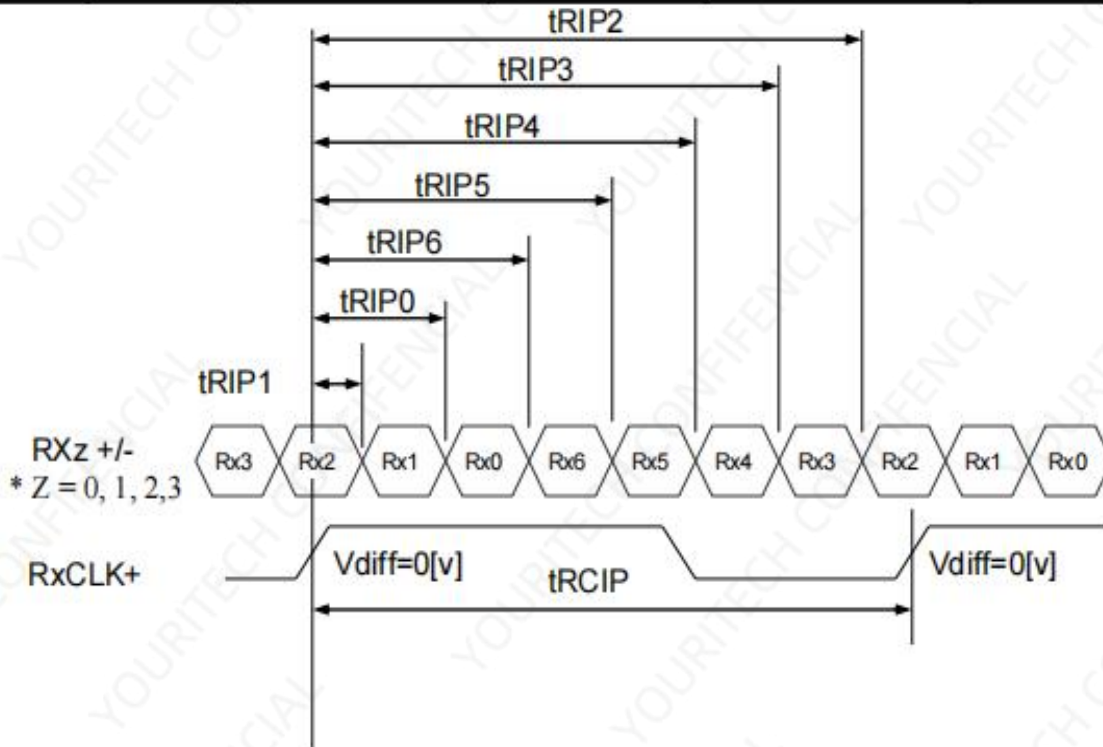


6. LVDS Signal Timing Characteristics

6.1 LVDS Rx Interface Timing Parameter

<Table 7. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	17.5	18.5	19.6	nsec	
Input Data 0	tRIP1	$0.5 \times tRCIP/7-0.4$	$0.5 \times tRCIP/7$	$0.5 \times tRCIP/7+0.4$	nsec	
Input Data 1	tRIP0	$1.5 \times tRCIP/7-0.4$	$1.5 \times tRCIP/7$	$1.5 \times tRCIP/7+0.4$	nsec	
Input Data 2	tRIP6	$2.5 \times tRCIP/7-0.4$	$2.5 \times tRCIP/7$	$2.5 \times tRCIP/7+0.4$	nsec	
Input Data 3	tRIP5	$3.5 \times tRCIP/7-0.4$	$3.5 \times tRCIP/7$	$3.5 \times tRCIP/7+0.4$	nsec	
Input Data 4	tRIP4	$4.5 \times tRCIP/7-0.4$	$4.5 \times tRCIP/7$	$4.5 \times tRCIP/7+0.4$	nsec	
Input Data 5	tRIP3	$5.5 \times tRCIP/7-0.4$	$5.5 \times tRCIP/7$	$5.5 \times tRCIP/7+0.4$	nsec	
Input Data 6	tRIP2	$6.5 \times tRCIP/7-0.4$	$6.5 \times tRCIP/7$	$6.5 \times tRCIP/7+0.4$	nsec	



* $V_{diff} = (RXz+) - (RXz-), \dots, (RXCLK+) - (RXCLK-)$



6.2 Signal Timing Specification

6.2.1 Timing Parameters(DE only mode)

< Table 8. Timing Table >

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	51	54	57	MHz
	High Time	Tch	-	4/7Tc	-	
	Low Time	Tcl	-	3/7Tc	-	
Frame Period		Tv	57	60	75	Hz
Horizontal Active Display Term	Valid	t _{HV}	-	640	-	t _{CLK}
	Total	t _{HP}	730	844	940	t _{CLK}
Vertical Active Display Term	Valid	t _{VV}	-	1024	-	t _{HP}
	Total	t _{VP}	1037	1066	1096	t _{HP}

Notes: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

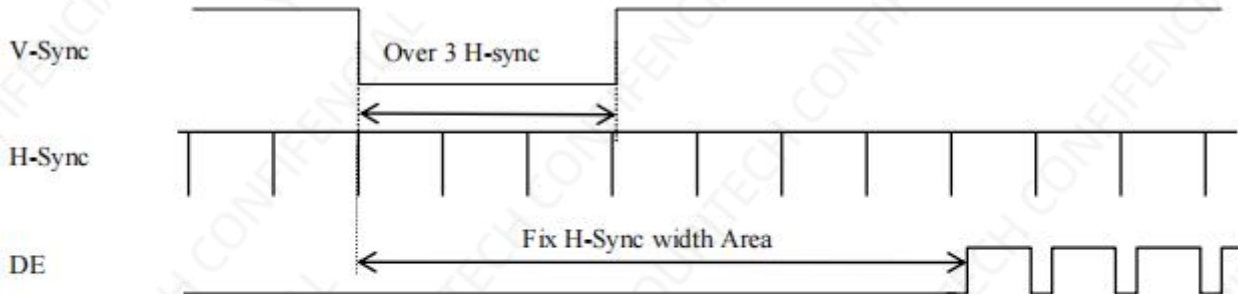
< Table 9. LVDS Input SSCG>

Symbol	Parameter	Condition	Min	Typ	Max	Unit
F	LVDS Input frequency	-	30	-	110	MHz
T _{LVSK}	LVDS channel to channel skew	F=75MHz V _{IC} =1.2V V _{ID} =±200mV	-400	-	+400	ps
F _{LVMOD}	Modulating frequency of input clock during SSC	F=75MHz V _{IC} =1.2V V _{ID} =±200mV	10	-	300	KHz
F _{LVDEV}	Maximum deviation of input clock frequency during SSC		-3	-	+3	%
T _{CY-CY}	Cycle to Cycle jitter		-	-	200	ps



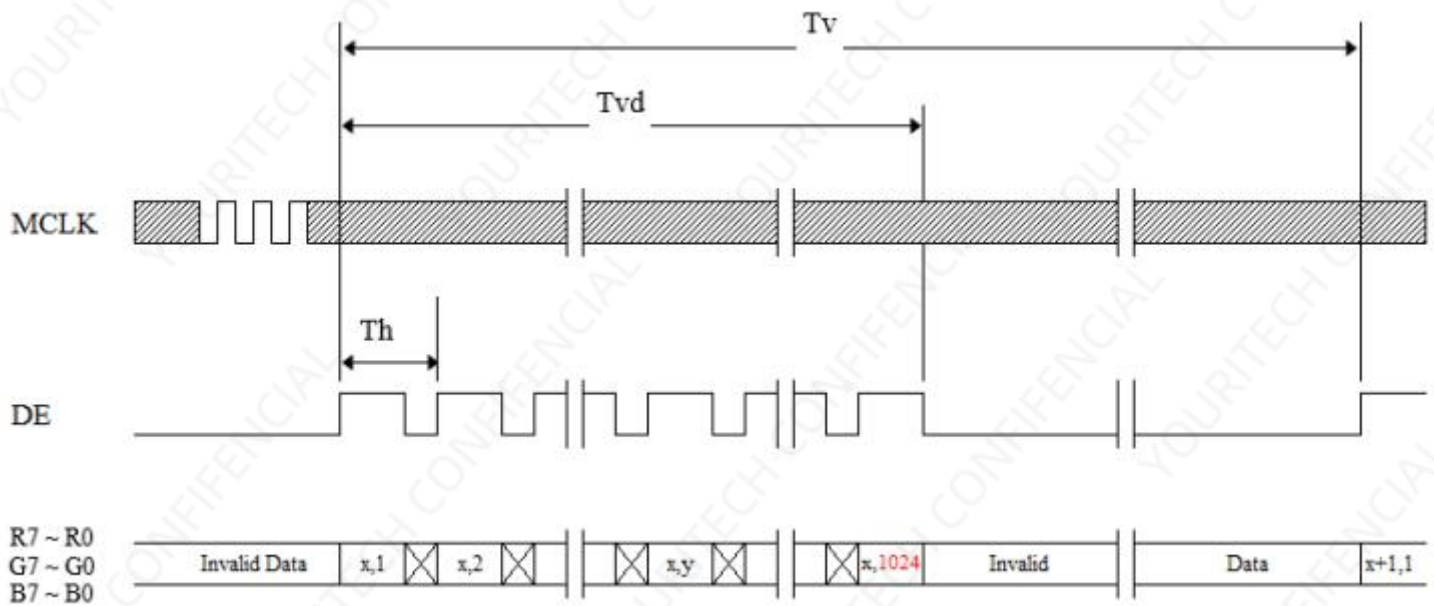
6.2.2 Signal Timing Waveform

Sync Timing Waveform

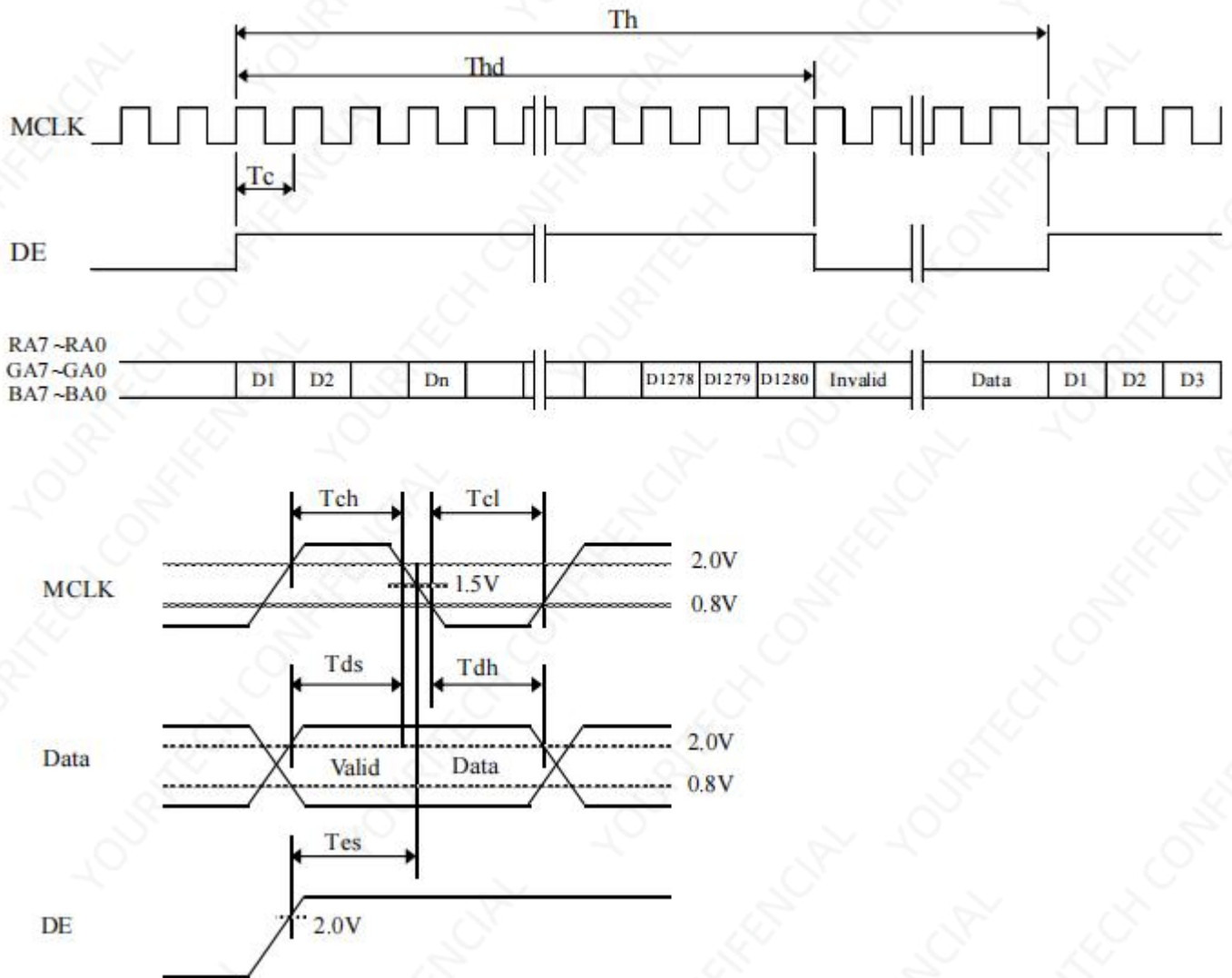


- 1) Need over 3 H-sync during V-Sync Low
- 2) Fix H-Sync width from V-Sync falling edge to first rising edge

Vertical Timing Waveform

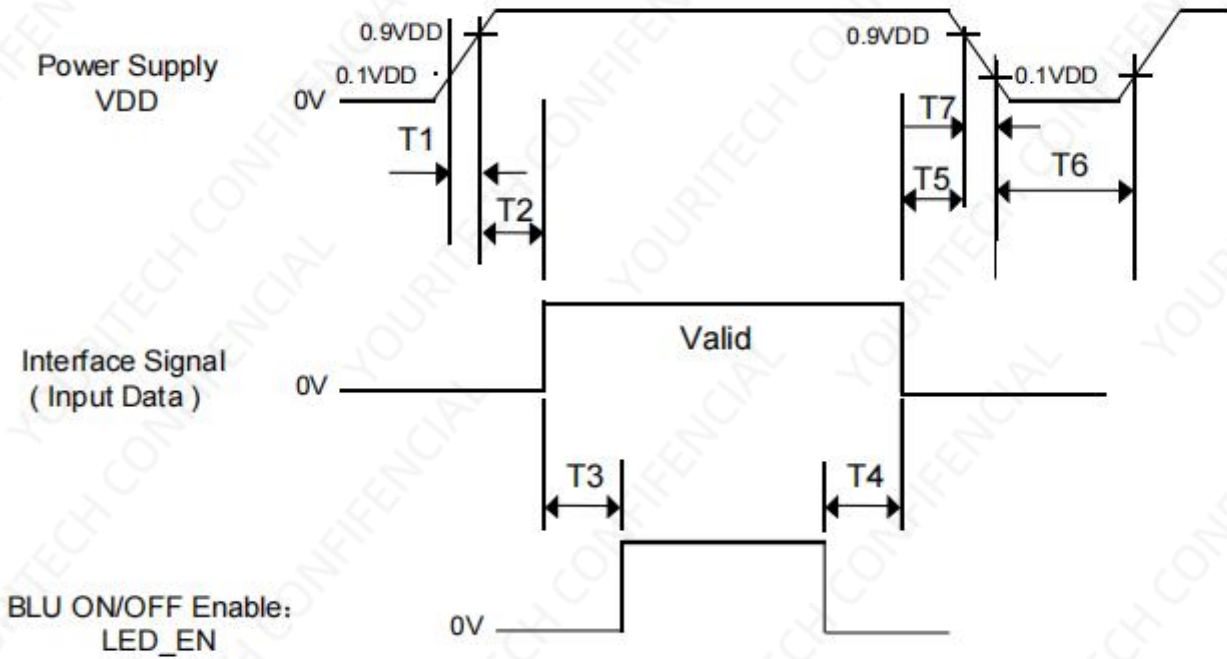


6.2.3 Horizontal Timing Waveform



6.3 Power Sequence

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



< Table 11. Sequence Table >

Parameter	Values			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	500	-	-	ms
T4	500	-	-	ms
T5	0	-	30	ms
T6	1	-	-	s
T7	0	-	10	ms

- Notes:
1. Back Light must be turn on after power for logic and interface signal are valid.
 2. Even though T1 is out of SPEC, it is still ok if the inrush current of VDD is below the limit.
 3. When $VDD < 0.9VDD(Typ.)$, Power off.
 4. T7 decreases smoothly, if there were rebounding voltage, it must smaller than 0.5 volts.



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.

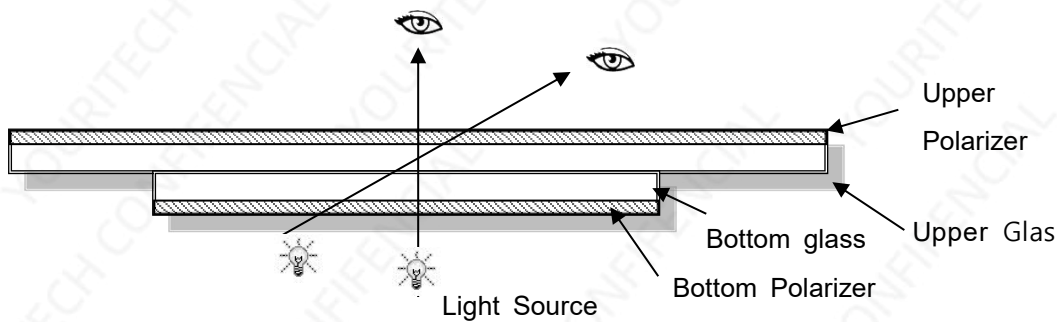
Temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $65\% \pm 10\% \text{RH}$

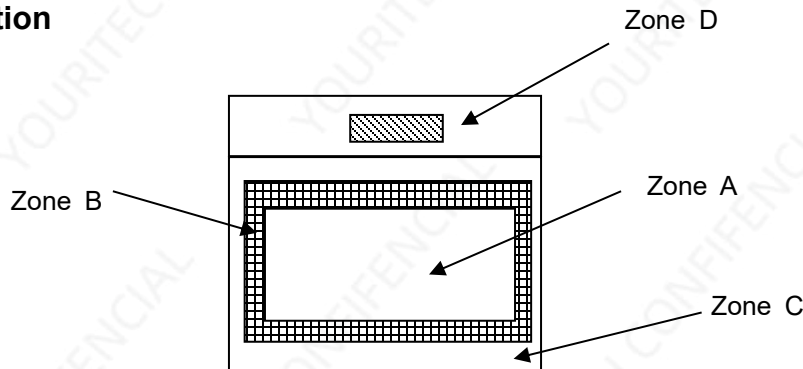
Viewing Angle : Normal viewing Angle.

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 2828-2012 ; , normal inspection, Class II

AQL:

Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , LCM: Liquid Crystal Module

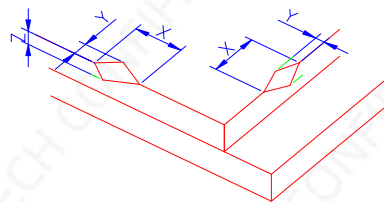
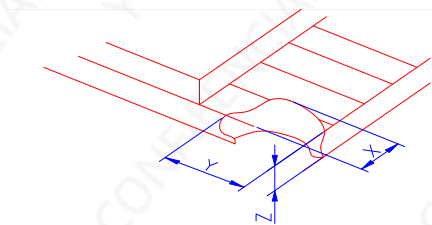
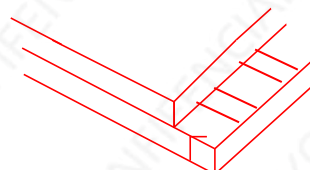
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc...	Major
2	Missing	Missing components and etc...	
3	Outline dimension	Overall outline dimension beyond the drawing 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 IT O, T: Height of LCD	(1) The edge of LCD broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></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><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	≤L	≤T
X	Y	Z						
≤3.0mm	≤L	≤T						
	(3) LCD crack	 Crack Not allowed						



Spot defect

2.0

Y

X

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

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

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

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

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

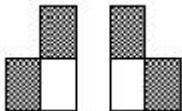
③ Polarizer accidented spot

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

④Polarizer Bubble

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



3.0	LCD Pixel defect	Pixel bad points																							
		<table> <tr> <th>Item</th><th>Zone A</th><th>Acceptable Qt</th></tr> <tr> <td rowspan="3">Bright dot</td><td>Random</td><td>$N \leq 2$</td></tr> <tr> <td>2 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>3 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td rowspan="3">Dark dot</td><td>Random</td><td>$N \leq 3$</td></tr> <tr> <td>2 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>3 dots adjacent</td><td>$N \leq 0$</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>$N \leq 4$</td></tr> </table> 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 (vertical)   2 dot adjacent 2 dot adjacent (slant)	Item	Zone A	Acceptable Qt	Bright dot	Random	$N \leq 2$	2 dots adjacent	$N \leq 0$	3 dots adjacent	$N \leq 0$	Dark dot	Random	$N \leq 3$	2 dots adjacent	$N \leq 0$	3 dots adjacent	$N \leq 0$	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		$N \leq 4$
Item	Zone A	Acceptable Qt																							
Bright dot	Random	$N \leq 2$																							
	2 dots adjacent	$N \leq 0$																							
	3 dots adjacent	$N \leq 0$																							
Dark dot	Random	$N \leq 3$																							
	2 dots adjacent	$N \leq 0$																							
	3 dots adjacent	$N \leq 0$																							
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		$N \leq 4$																							



4.0	Line defect (LCD /Polarizer backlight black/white line, scratch, stain)  W: width, L : length N : Count	Width(mm)	Length(m m)	Acceptable Qty		
				A	B	C
		$\Phi \leq 0.05$	Ignore	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			
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	85°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	-30°C, 96HR	
High Temperature Storage	85°C, 96HR	
Low Temperature Storage	-30°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.



10. Packing

---TBD-----

