SPECIFICATION
FOR
TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE : _____

HL MODEL : HG101WU076

■**Preliminary Specification**

■**Final Specification**

Customer Confirmation column:

Approved by :_____Dept. :_____Data :_____

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Designed by	Checked by	Approved by

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1.0 GENERAL DESCRIPTION

1.1 Introduction

HG101WU076 is a color active matrix TFT LCD module using LTPS TFT's (Thin Film Transistors) as an active switching devices. This module has a 10.1 inch diagonally measured active area with WUX GA resolutions (1200)horizontal by 1920 .vertical pixel array . Each pixel is divided into RED, GREE N, BLUE dots which are arranged in vertical stripe and this module can display 8bit colors and color ga mut typ. 64% @ C Light.. The LED driver for back-light driving is built in this model.
All input signals are LVDS interface compatible.

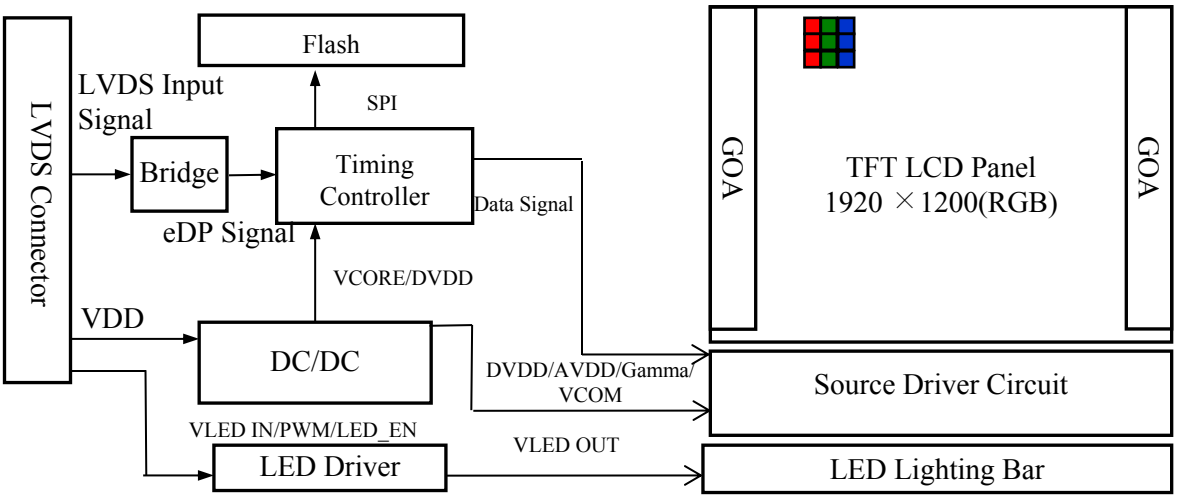


Figure 1. Drive Architecture

1.2 Features

- LVDS Interface with 2 pixel / clock
- 8bit color depth, color gamut typ 64% @ C light
- Single LED lighting bar (Bottom side/Horizontal Direction)
- Both Data enable , Hsync , Vsync signal
- Green product (RoHS & Halogen free product)
- On board LED driving circuit
- Low driving voltage and low power consumption
- Adjust brightness with PWM pin

1.3 Application

- Photographic equipment applications

1.4 General Specification

The followings are general specifications at the model HG101WU076 . (listed in Table 1)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	217.728 (H) ×136.080 (V)	Mm	
Number of pixels	1920 (H) ×1200 (V)	Pixels	
Pixel pitch	113.4(H) ×113.4(V)	um	
Pixel arrangement	RGB Vertical stripe		
Display colors	8bit		
Color gamut	typ. 64%		C Light
Display mode	Normally Black		
Dimensional outline	225.13(H)×148.34(V)×2.28(Max.)(W/O PCB) 222.73(H)×180.03(V)×4.05(Max.)(W/I PCB)	Mm	
Weight	TYP	G	
Surface treatment	HC		
Surface hardness	3H		
Back-light	Bottom edge side, 1-LED lighting bar type		Note 1

Notes : 1. LED Lighting Bar (60*LED Array)

2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Absolute Maximum Ratings>

Ta=25+/-2° C

Parameter	Symbol	Min.	Max.	Unit	Remarks
LCD Power Supply	V_{LCD}	-0.3	3.6	V	Note 1
LED Power Supply	V_{LED}	-0.3	25	V	
Operating Temperature	T_{OP}	-30	+80	° C	Note 2
Storage Temperature	T_{ST}	-30	+80	° C	

Notes :
1. Permanent damage to the device may occur if maximum values are exceeded functional operation should be restricted to the condition described under normal operating conditions.
2. Temperature and relative humidity range are shown in the figure below.
95 % RH Max. (40 ° C ≥ Ta) Maximum wet-bulb temperature at 39° C or less.(Ta >40° C)No condensation.

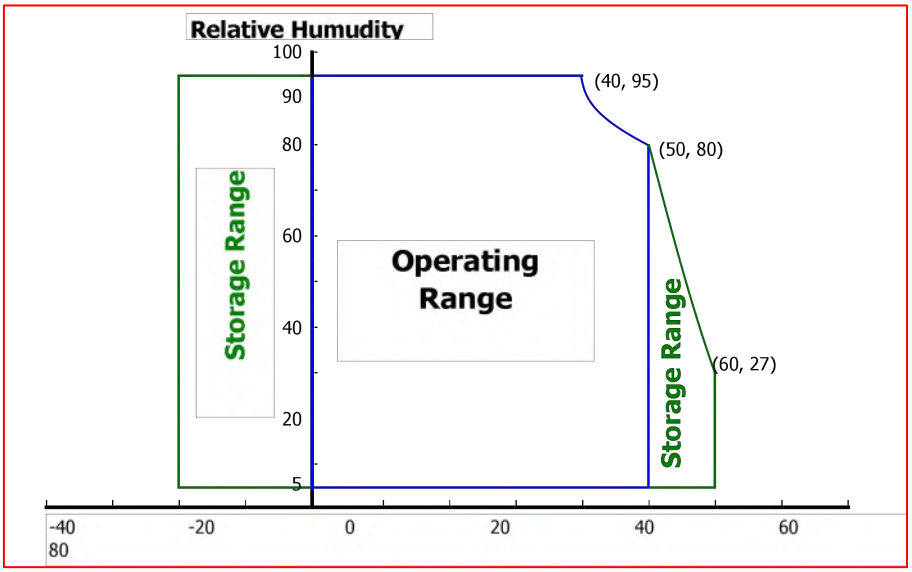


Figure 2. Temperature and Relative Humidity Range

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical Specifications > Ta=25+/-2° C

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{LCD}	3.0	3.3	3.6	V	Note 1
Power Supply Inrush Current	Inrush	-	-	2.0	A	Note2
Permissible Input Ripple Voltage	V_{RF}	-5% VDD	-	+5% VDD	V	Note 1,3
Power Supply Current	I_{LCD}	-	320	420	mA	Note 4
Power Consumption	P_M	-	1.1	1.9	W	
High Level Differential Input Threshold Voltage	V_{IH}	-	-	100	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-100	-	-	mV	
Differential input voltage	$\|V_{ID}\|$	200	-	600	mV	V_{IH}=100mV, V_{IL}=-100mV
Differential input common mode voltage	Vcm	0.9	-	1.4	V	

Notes :

1. The supply voltage is measured and specified at the interface connector of LCM.
   The current draw and power consumption specified is for V_{DD} = 3.3V, Frame rate = 60Hz at 25 ° C.(Typ. value for reference) , The pattern and Power Consumption is shown for reference only

a) Mosaic

2. Duration of rush current is about 2 ms and rising time of VDD
3. Ripple Voltage should be covered by Input voltage Spec
4. Calculated value for reference (Inputs*VPIN*IPIN) including inverter loss

3.2 Backlight Unit

< Table 4. LED Driving Guideline Specifications > Ta=25+/-2° C

Parameter			Min.	Typ.	Max.	Unit	Remarks
Power supply voltage for LED Driver		V_{LED}	11	12	13	V	
Power supply Current for Back light		V_{BLU}		30	33	V	
Power supply Current for Back light		I_{BLU}	-	300	-	mA	背光灯串：4串16并
Power supply for Back light		P_{BL_PWR}	-	10	12	W	1.Note 1 2.LED Power Consumption follow customerrequirements
EN Control Level	Backlight on	V_{ENH}	2	-	V_{LED}	V	EN logic high voltage
	Backlight off	V_{ENL}	0	-	0.8	V	EN logic low voltage
PWM Control Level	PWM High Level	V_{PML}	2.0	-	V_{LED}	V	
	PWM Low Level	V_{PML}	0	-	0.8	V	
PWM Control Frequency		F_{PWM}	200	-	20k	Hz	
Duty Ratio		-	25	-	100	%	

Notes : 1. Calculator Value for reference $I_{BLU} \times V_{BLU} = P_{BL_PWR}$*85%

2. The LED Life-time define as the estimated time to 50% degradation of initial luminous under the condition of the ambient temperature of 25℃.

4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25±2℃) with the equipment of luminance meter system (SR-3AR) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. We refer to θØ=0 (=θ3) as the 3 o'clock direction (the "right"), θØ=90 (= θ12) as the 12 o'clock direction ("upward"), θØ=180 (= θ9) as the 9 o'clock direction ("left") and θØ=270(= θ6) as the 6 o'clock direction ("bottom"). While scanning θand/or Ø, the center of the measuring spot on the display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be 3.3+/- 0.3V at 25°C.

4.2 Optical Specifications

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ_3	CR ≥ 10	80	85	-	Deg.	Note 1
		Θ_9		80	85	-	Deg.	
	Vertical	Θ_{12}		80	85	-	Deg.	
		Θ_6		80	85	-	Deg.	
Contrast ratio(Center)		CR	Θ = 0°	800	1200	-		Note 2
Transmittance		-	Θ = 0°	4.1	4.6	-	%	@ Silicate BLU，wo CG,wo haze,wo APF,wo 3Gamma
White Chromaticity		W_x	Θ = 0°	0.295	0.325	0.355		Note 5 C Light CIE1931
		W_y		0.299	0.329	0.359		
Color	Red	Rx	Θ = 0°	Typ.-0.03	0.640	Typ.+0.03		
		Ry			0.345			
	Green	Gx			0.310			
		Gy			0.566			
	Blue	Bx			0.141			
		By			0.065			
Color Gamut				59	64	-	%	C Light
Response Time (Rising + Falling)		T_{RT}	Ta= 25℃ Θ = 0°	-	30	35	ms	Note 4
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 5
Gamma		-	-	1.9	2.2	2.5		

Notes :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see Figure 7).

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

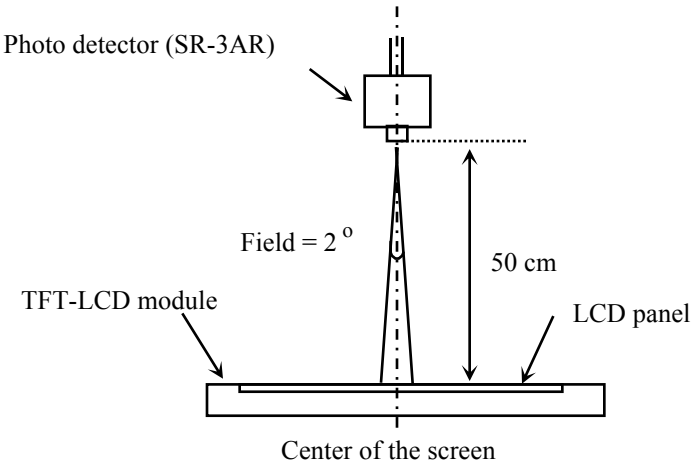
2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see Figure 7) Luminance Contrast Ratio (CR) is defined mathematically.

3. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

4. The electro-optical response time measurements shall be made as Figure 10 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r, and 90% to 10% is T_f.

5. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (Y_B) of that same area when any adjacent area is driven dark. (See Figure 11).

4.3 Optical Measurements



Optical characteristics measurement setup

Figure 7. Measurement Set Up

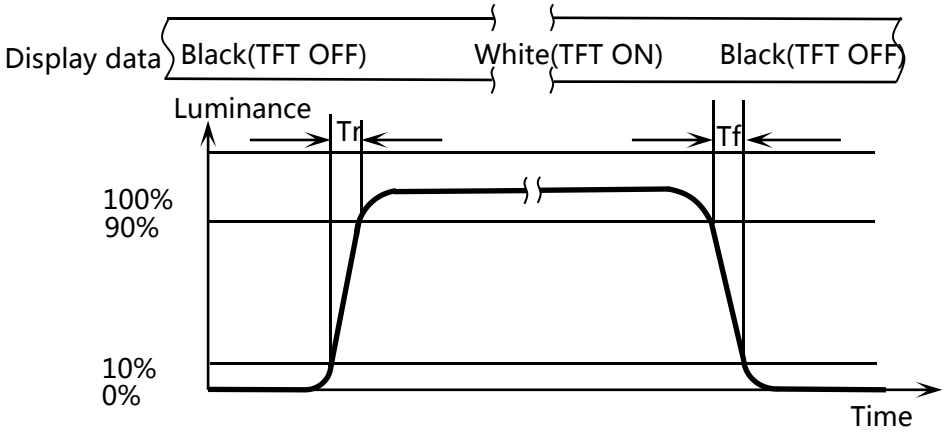
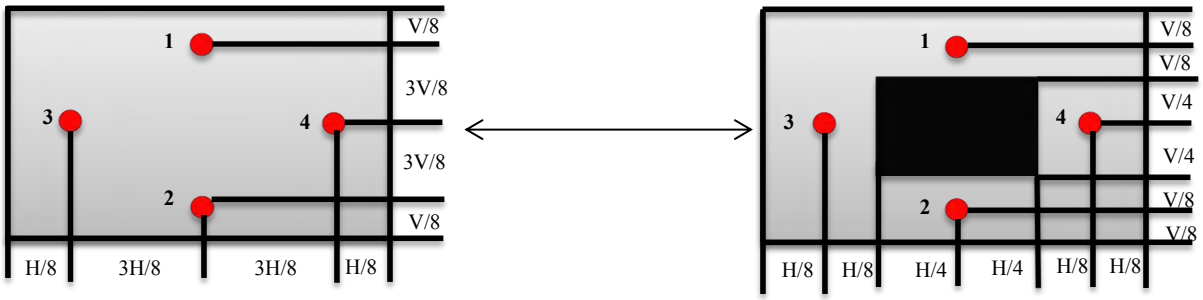


Figure 8. Response Time Testing

The electro-optical response time measurements shall be made as shown in Figure 10 by switching the "data" input signal ON and OFF. Tr: The luminance to change from 10% to 90% ,Tf: The luminance t o change from 90% to 10% .

The test system : SR-3AR



$$\text{Cross Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Figure 9. Cross Talk Modulation Test Description

Where:

Y_A = Initial luminance of measured area (cd/m²)

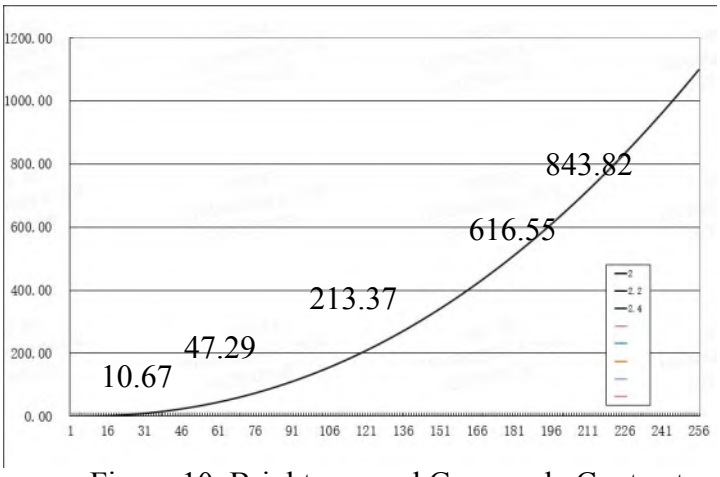
Y_B = Subsequent luminance of measured area (cd/m²)

The location 1/2/3/4 measured will be exactly the same in both patterns. The test background gray is from L64 to L192.Take the largest data as the result.

Cross Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of tha t same area when any adjacent area is driven dark.(Refer to Figure 9)

The test system: SR-3AR

nit



Gray-scale

Figure 10. Brightness and Gray-scale Contrast

5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The electronics interface connector is FH345RJ-45S-0.5SH(50) or Compatible.
The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	VLEDIN	Power for LED backlight	25	OLV2P	LVDS Positive data signal
2	VLEDIN	Power for LED backlight	26	OLV2N	LVDS Negative data signal
3	VLEDIN	Power for LED backlight	27	GND	Ground
4	PWM	PWM For LED	28	OLVCLKP	LVDS Positive CLK signal
5	LED EN	LED ENABLE	29	OLVCLKN	LVDS Negative CLK signal
6	GND	Ground	30	GND	Ground
7	ELV3P	LVDS Positive data signal	31	OLV1P	LVDS Positive data signal
8	ELV3N	LVDS Negative data signal	32	OLV1N	LVDS Negative data signal
9	GND	Ground	33	GND	Ground
10	ELV2P	LVDS Positive data signal	34	OLV0P	LVDS Positive data signal
11	ELV2N	LVDS Negative data signal	35	OLV0N	LVDS Negative data signal
12	GND	Ground	36	GND	
13	ELVCLKP	LVDS Positive CLK signal	37	I2C_SDA	Data input/output for I2C
14	ELVCLKN	LVDS Negative CLK signal	38	I2C_SCL	Clock signal for I2C
15	GND	Ground	39	NC	No Connection
16	ELV1P	LVDS Positive data signal	40	EEPEN	Only test Pin
17	ELV1N	LVDS Negative data signal	41	VDDIN	Power Supply
18	GND	Ground	42	VDDIN	Power Supply
19	ELV0P	LVDS Positive data signal	43	VDDIN	Power Supply
20	ELV0N	LVDS Negative data signal	44	VDDIN	Power Supply
21	GND	Ground	45	VDDIN	Power Supply
22	OLV3P	LVDS Positive data signal			
23	OLV3N	LVDS Negative data signal			
24	GND	Ground			

6.0 SIGNAL TIMING SPECIFICATION

6.1 The NE140QDM-N41 Is Operated By The DE Only

< Table 7. Signal Timing Specification >

Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	10.17	12.99	13.6	ns	
	Frequency	-	73.1	77	98.3	MHz	
Hsync	Period	Th	995	1920	1260	tCLK	
	Horizontal Valid	Thv	960	960	960	tCLK	
	Horizontal Blank	Thb	35	80	300	tCLK	
	Frequency	fH	73.5	74.1	78	KHz	
Vsync	Period	Tv	1225	1200	1300	Th	
	Vertical Valid	Tvd	1200	1200	1200	Th	
	Vertical Blank	Tvb	25	35	100	Th	
	Frequency	fV	60	60	60	Hz	
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	3	%	

Note : The DCLK range at last line of V-blanking should be set in 0-H-active/2

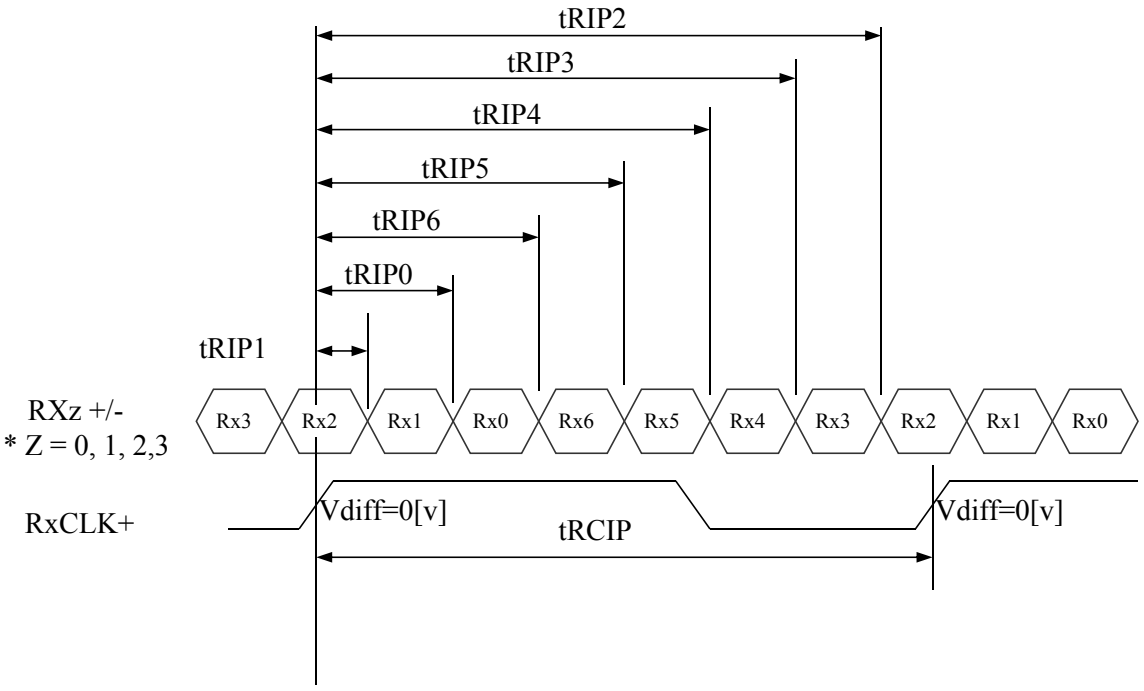
6.0 SIGNAL TIMING SPECIFICATION

6.2 LVDS Rx Interface Timing

The specification of the LVDS Rx interface timing parameter is shown in Table8.

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.17	12.99	13.6	nsec	
Input Data 0	tRIP1	-0.4	0	0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2×tRCIP/7-0.4	2×tRCIP/7	2×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3×tRCIP/7-0.4	3×tRCIP/7	3×tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4×tRCIP/7-0.4	4×tRCIP/7	4×tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5×tRCIP/7-0.4	5×tRCIP/7	5×tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6×tRCIP/7-0.4	6×tRCIP/7	6×tRCIP/7+0.4	nsec	

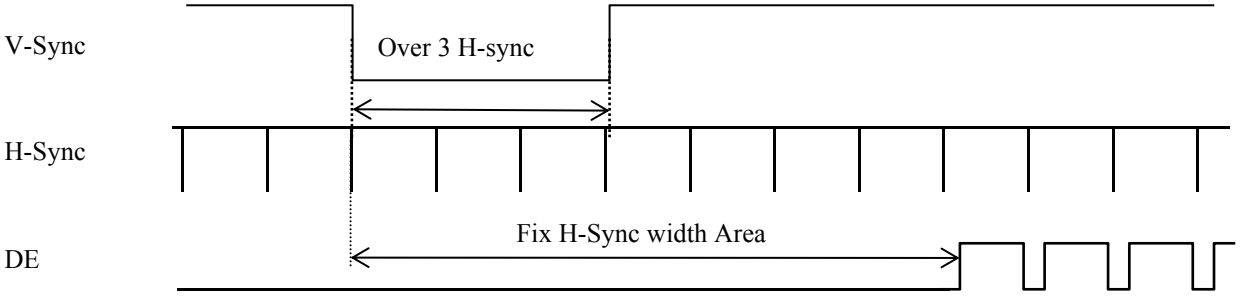
< Table 8. The LVDS Rx interface timing parameter



* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

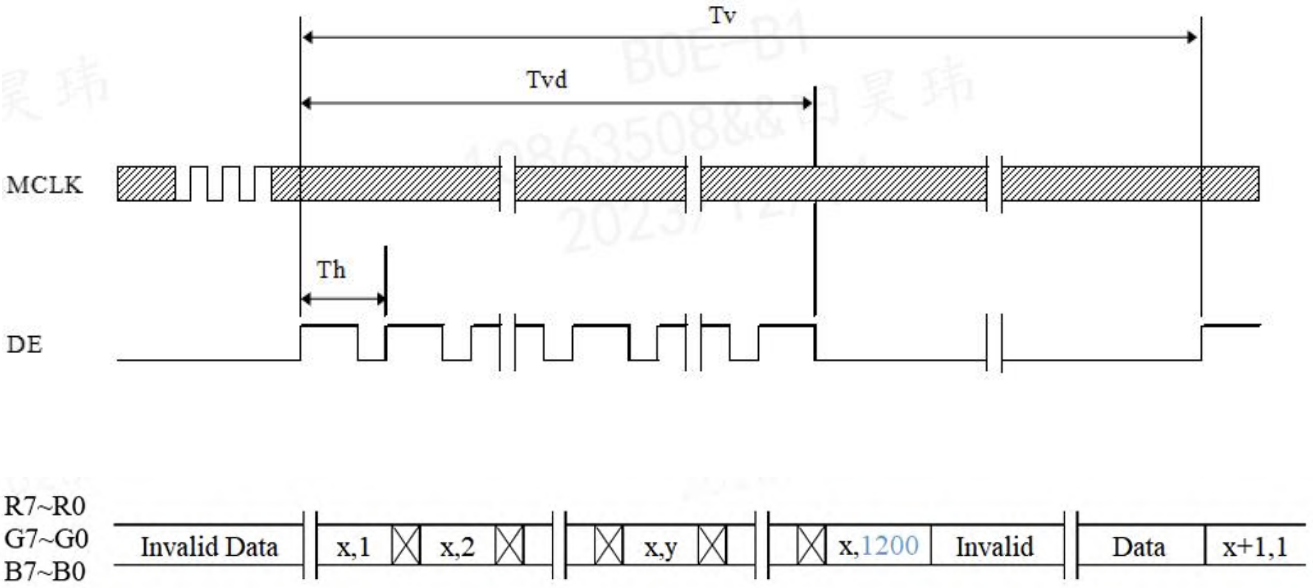
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms



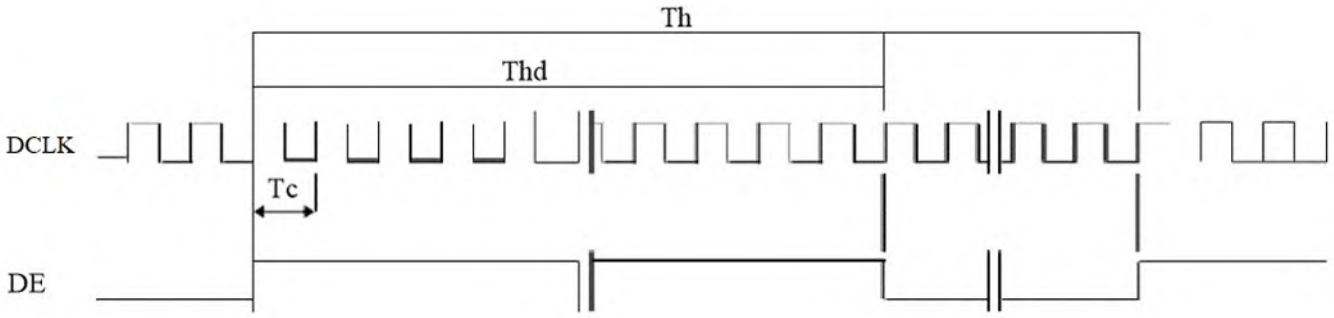
1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

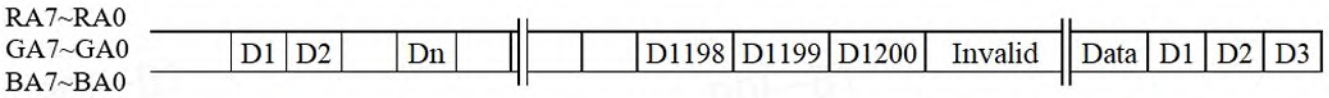
7.2 Vertical Timing Waveforms

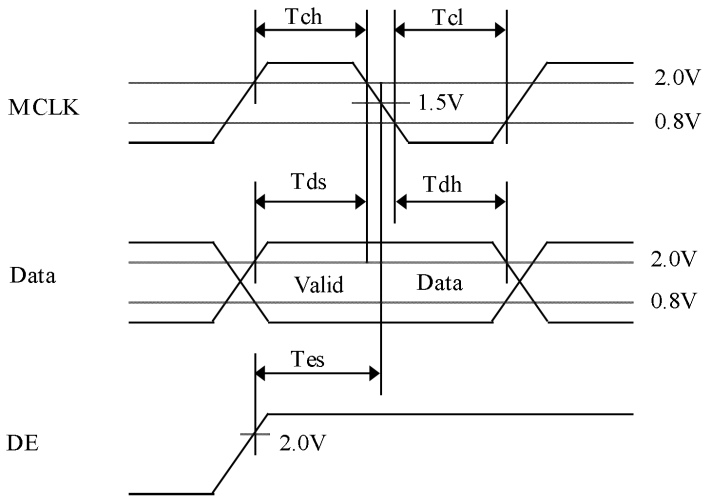


7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.3 Horizontal Timing Waveforms

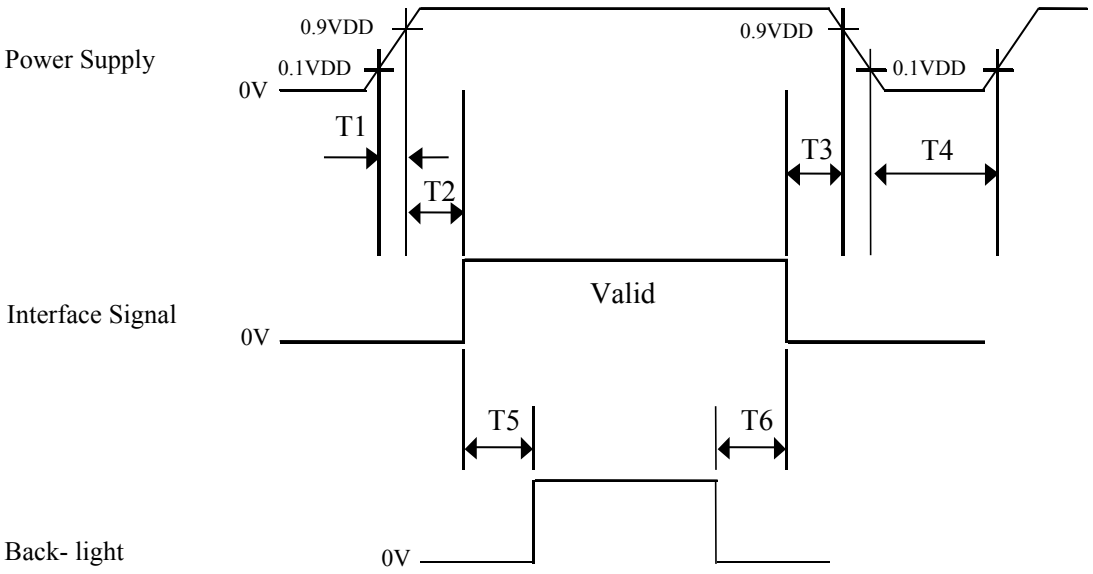






8.0 POWER SEQUENCE（需要实测）

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



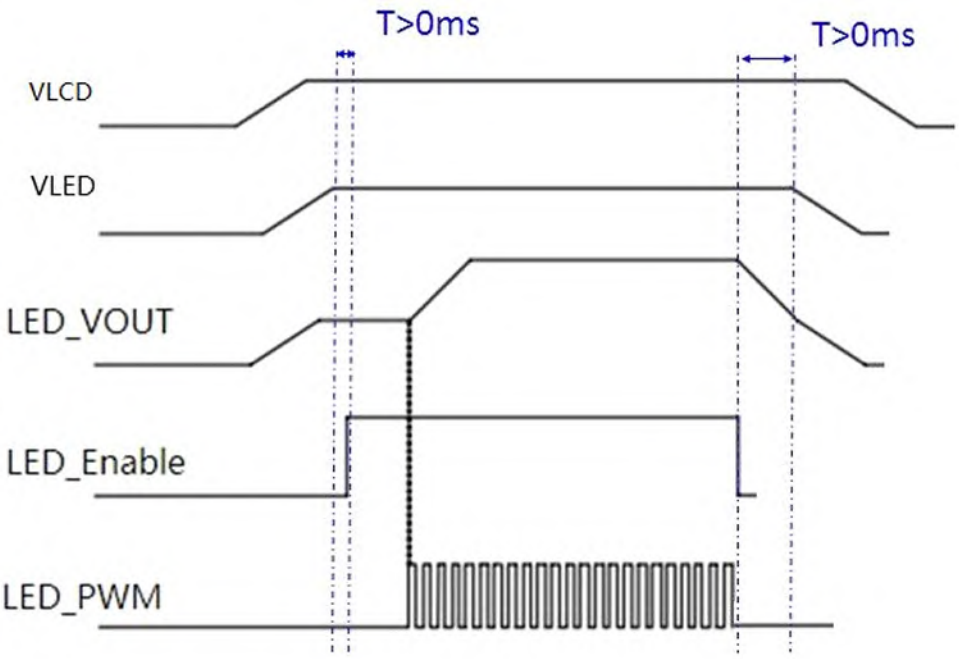
0.5 ms ≤ T1 ≤ 10 ms
0 ≤ T2 ≤ 50 ms
0 < T3 ≤ 50 ms
1 sec ≤ T4
200 ms ≤ T5
200 ms ≤ T6

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on
3. Back Light must be turn on after power for logic and interface signal are valid.
4. If T3=0ms, there is a risk of flicker when power On/Off
5. If T6=0ms, there is a risk of abnormal display when power off

8.0 POWER SEQUENCE（需要实测）

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



Note:

1.For LED Driver only

9.0 MECHANICAL CHARACTERISTICS

9.1 Dimensional Requirements

Figure 11 shows mechanical outlines for the model HG101WU076.
Other parameters are shown in Table 9.

<Table 9. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	217.728 (H) ×136.080 (V)	mm
Number of pixels	1920 (H) X 1200 (V) (1 pixel = R + G + B dots)	pixels
Pixel pitch	113.4(H) X 113.4(V)	um
Pixel arrangement	RGB Vertical stripe	
Display colors	8bit	
Display mode	Normally Black	
Dimensional outline	225.13(H)×148.34(V)×2.28(Max.)(W/O PCB) 222.73(H)×180.03(V)×4.05(Max.)(W/I PCB)	mm
Weight	TBD	g

9.2 Hard coating and Polarizer Hardness.

The surface of the LCD has a hard coating polarizer, The polarizer hardness is 3B.

9.3 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux.

10.0 RELIABILITY TEST

The reliability test items and its conditions are shown in below.

<Table 10. Reliability Test>

No	Test Items	Conditions	Remark
1	CR/Transmittance/Rt/Flicker	Ta = 25° C	
2	High temperature storage test	Ta = 80° C , 240 hrs	
3	Low temperature storage test	Ta = -30° C , 240 hrs	
4	High temperature operation test	Ta = 80° C , 240 hrs	
5	Low temperature operation test	Ta = -30° C , 240 hrs	
6	Low temperature operation test	Ta = -40° C , 240 hrs	
7	High temperature & high humidity storage test	Ta = 60° C , 90%RH, 240 hrs	
8	High temperature & high humidity operation test	Ta = 60° C , 90%RH, 240 hrs	
9	High temperature & high humidity storage test	Ta = 85° C , 85%RH, 120 hrs	
10	Ordinary temperature operation test	Ta = 25° C , 240 hrs	
11	Thermal shock storage test	Ta = -30 ° C ↔ 80 ° C (0.5 hr), 100 cycle	
12	Thermal shock operation test	Ta = -30 ° C ↔ 80 ° C (0.5 hr), 100 cycle	
13	PCT	Ta =121℃，100%RH，2atm，24hr	
14	Image Sticking	Ta =50℃，Chess 5*5，Switch to L127 gray after lighting 1hr, The positive viewing angle disappears in 3min	
15	UV Aging test	UV Intensity ：0.77W/m2,WL= 340nm Light: 60℃/4hr,No Light:50℃/4hr，25cycle	
16	Electro-static discharge test (operating)	Air ：150 pF, 330Ω, ±8 KV Contact ：150 pF, 330Ω, ±4 KV Ta = 25°C , 60%RH, Class B	
17	Peel off	10mm/min,48hr	

11.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module
- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module
- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

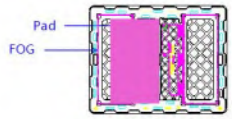
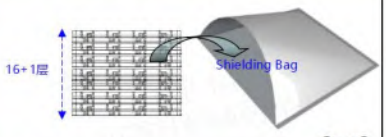
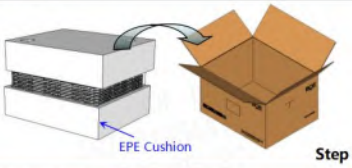
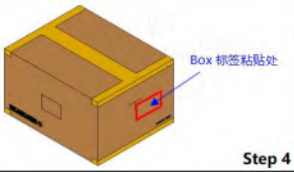
(4) Cautions for the atmosphere
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

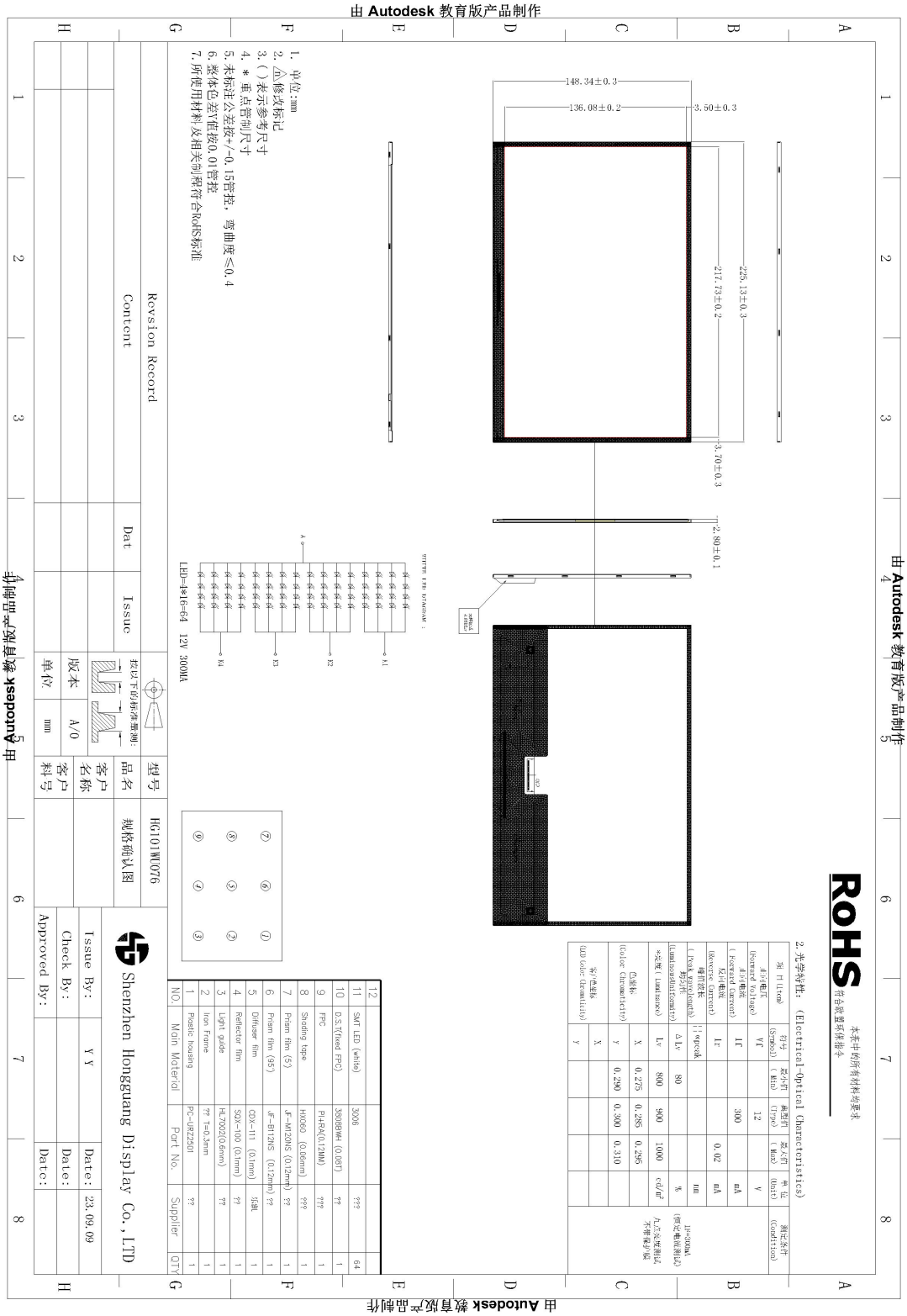
(6) Other cautions
- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc. Please pack the module not to be broken. We recommend to use the original shipping packages.

12.0 PACKING INFORMATION

12.1 Packing Order

将FOG 平放入Tray，CF朝上放置，PCB指向“PCB”标识方向，产品上放置1pcs Pad 2 FOG/2 Pad/Tray	将16pcs Tray直叠堆叠码放，不可旋转，顶部放置1pcs 空Tray，并放入Shielding Bag中，抽真空封口 17 Tray/Box 1 Shielding Bag/Box	将1包Tray平放入Box上下放置EPE Cushion 2 EPE Cushion/Box 32 FOG/Box
 Step 1	 Step 2	 Step 3
采用“H”形封箱方式，对Box进行封箱，并粘贴Box标签	每个Pallet上放4层Box，每层按照“田”字形码放4箱，长、宽、高方向安放护角，长、宽、高边捆绑2道打包带，Pallet外进行至少3层缠膜5个面包裹，并粘贴Pallet标签 16 Box/Pallet, 512 FOG/Pallet	厢车装载方式：双横双层码放 厢车装载量_12m：108,000pcs（52托）
 Step 4	 Step 5	 Step 6

13.0 MECHANICAL OUTLINE DIMENSION



14.0 GENERAL PRECAUTIONS

14.1 HANDLING

(1) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist or bend the modules.

(2) Refrain from strong mechanical shock or any force to the module. Otherwise, it may cause improper operation or damage to the module.

(3) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than 1 HB pencil lead.

(4) Wipe off water droplets or oil immediately. If you leave 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 Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently 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 module.

(9) Use fingerstalls with soft gloves to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Do not pull or fold the LED FPC.

(l2) Do not touch any component which is located on the back side.

(13) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(14) Pins of connector shall not be touched directly with bare hands.

14.2 STORAGE

(1) Do not leave the module 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. It is prohibited to apply sunlight or fluorescent light during the stor e.

14.3 OPERATION

(1) Do not connect, disconnect the module in the " Power On" condition.

(2) Power supply should always be turned on/off by following item 8.0 " Power on/off sequence ".

(3) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(4) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, BOE is not to be held reliable for the defective operations. It is strongly recommended to contact BOE to find out fitness for a particular purpose.

14.4 OTHERS

(1) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(2) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, Variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.

(3) If the module displays the same pattern continuously for a long period of time, it can be the situation when The " image sticks" to the screen.

(4) This module has its circuitry PCB's on the rear or bottom side and should be handled carefully to avoid being stressed.