SPECIFICATION
FOR
TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE : _____

HG MODEL : HG101WU080

☐**Preliminary Specification**

■**Final Specification**

Customer Confirmation column:

Approved by : _____ Dept. : _____ Data : _____

Please return one of the copies of the specification with your signature to us within two weeks after you receive this document. If it is not returned, we will assume that you agree to the entire contents of this specification document.

Designed by	Checked by	Approved by

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HG101WU080 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 eDP interface compatible.

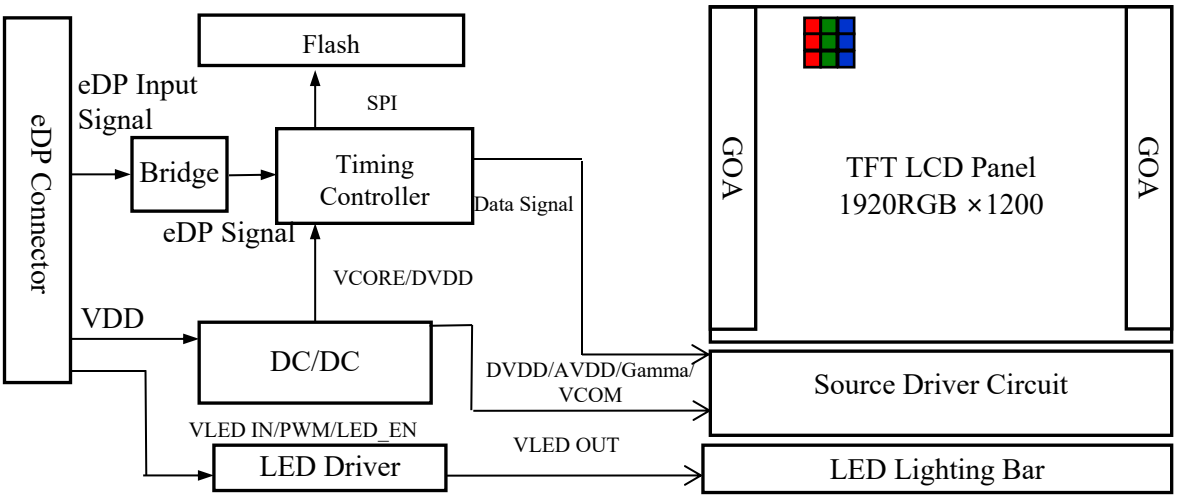


Figure 1. Drive Architecture

1.2 Features

- eDP Interface
- 8bit color depth, color gamut typ 64% @ C light
- Single LED lighting bar (Bottom side/Horizontal Direction)
- Data enable signal mode
- 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 HG101WU080.(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	228.20(L)×149.00(W)×2.35(H)(W/O PCB)	Mm	
Weight	165+/-10	g	
Surface treatment	AG		
Surface hardness	3H		
Back-light	Bottom edge side, 1-LED lighting bar type		Note 1
Power consumption	TBD	W	@mosaic
	TBD	W	
	TBD	W	

Notes : 1. LED Lighting Bar (40*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_{DD}	-0.3	3.6	V	Note 1
LED Power Supply	V_{IN}	TBD	32	V	
Operating Temperature	T_{OP}	-40	+70	°C	Note 2
Storage Temperature	T_{ST}	-40	+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.

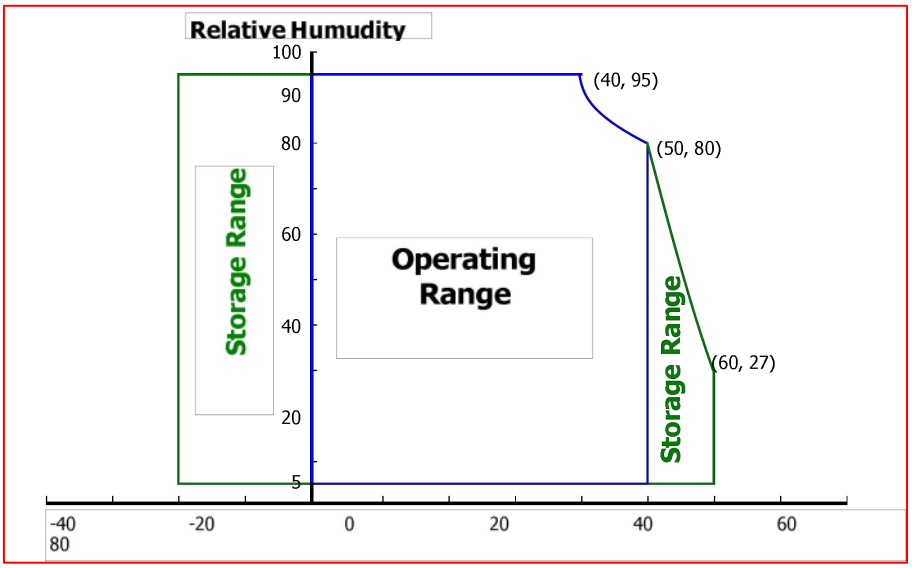


Figure 2. Temperature and Relative Humidity Range

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_{DD}	3.0	3.3	3.6	V	Note 1
Permissible Input Ripple Voltage		V_{RF}	-10% VDD	-	+10% VDD	V	@ V_{DD} = 3.3 V ，Note4
Power Supply Inrush Current		Inrush	-	-	TBD	A	Note3
Power Supply Current	Mosaic	I_{DD}	-	TBD	TBD	mA	Note 1
	R/B		-	TBD	TBD	mA	
	G		-	TBD	TBD	mA	
	Heavy Pattern			TBD	TBD	mA	
Power Consumption	Mosaic	P_M	-	TBD	TBD	W	
	R/B	P_R	-	TBD	TBD	W	
	G	P_G		TBD	TBD	W	
	BLU	P_{BL}	-	3.9	4.1	W	Note 2
	Total	P_{Total}	-	TBD	TBD	W	Note 1 @mosaic
SDA&SCL Control Level		High Level	TBD	TBD	TBD	V	@VDDIO=1.8V
		Low Level	TBD	TBD	TBD	V	

3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

Notes :

1. The supply voltage is measured and specified at the interface connector of LCM.
   The current draw and power consumption specified is for 3.3V at 25 °C.(Typ. value for reference)
   a) Mosaic pattern 8*8
   b) R/G/B patterns
   The pattern and Power Consumption is shown for reference only

(a) (b)

Figure 3. Power Measure Patterns

2. Calculated value for reference ($V_{LED} \times I_{LED}$) , The power consumption with LED Driver are under the VLED = 30.0V , 25℃, PWM Duty 100% .
3. Measure condition (Figure 4)
4. Input voltage range:3.0~3.6V.Test condition: Oscilloscope bandwidth 20MHz, AC coupling

3.2 Backlight Unit

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

Parameter			Min.	Typ.	Max.	Unit	Remarks
Power supply voltage for LED Driver		V_{LED}	-	6.0	6.4	V	
Power supply Current for Back light		V_{BLU}		30	32	V	
Power supply Current for Back light		I_{BLU}	-	128	-	mA	背光灯串：8并5串
Power supply for Back light		P_{BL_PWR}	-	4.51	4.82	W	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}	100	-	50,000	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
Surface Luminance		Lv	T=25℃	800	1000	-	Cd/m2	@ Silicate BLU，wo CG,wo haze,wo APF,wo 3Gamma
White Chromaticity		W_x	Θ = 0°	0.272	0.302	0.332		Note 5 C Light CIE1931
		W_y		0.299	0.329	0.359		
Color	Red	Rx	Θ = 0°	Typ.-0.03	TBD	Typ.+0.03		
		Ry			TBD			
	Green	Gx			TBD			
		Gy			TBD			
	Blue	Bx			TBD			
		By			TBD			
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).

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

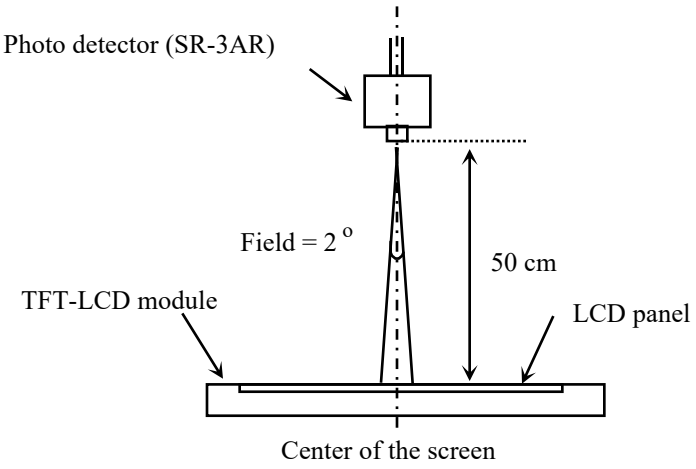
2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see Figure 7) Luminance Contrast Ratio (CR) is defined mathematically.

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

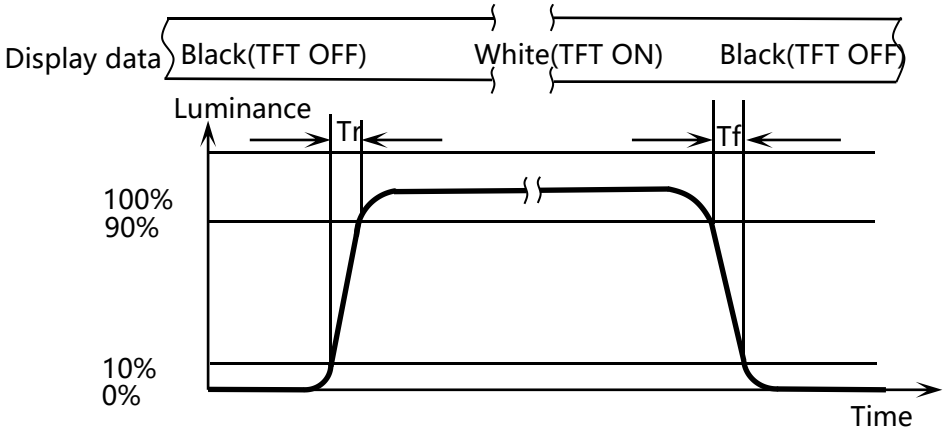
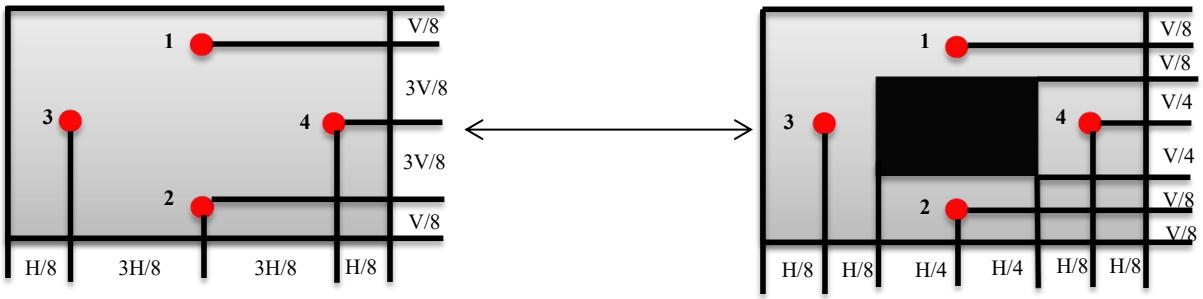


Figure 8. Response Time Testing

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

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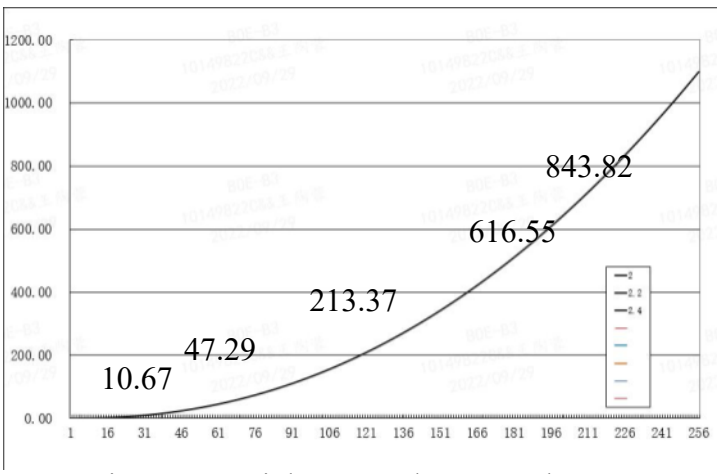


Gray-scale

Figure 10. Brightness and Gray-scale Contrast

5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The electronics interface connector is MSAK24025P30 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	NC	No Connection	25	NC	No Connection
2	H_GND	Ground	26	VLED	LED Power Supply 12V
3	Lane 1-N	data signal	27	VLED	LED Power Supply 12V
4	Lane 1-P	data signal	28	VLED	LED Power Supply 12V
5	H_GND	Ground	29	VLED	LED Power Supply 12V
6	Lane 0-N	data signal	30	NC	No Connection
7	Lane 0-P	data signal			
8	H_GND	Ground			
9	AUX_CH_P	The positive differential signal			
10	AUX_CH_N	The positive differential signal			
11	H_GND	Ground			
12	LCD_VCC	Supplies operating power			
13	LCD_VCC	Supplies operating power			
14	NC	No Connection			
15	LCD_GND	Ground			
16	LCD_GND	Ground			
17	HPD	Hot Plug Detect			
18	LED_GND	LED Cathode			
19	LED_GND	LED Cathode			
20	LED_GND	LED Cathode			
21	LED_GND	LED Cathode			
22	LED_EN	EN For LED			
23	LED_PWM	PWM For LED			
24	NC	No Connection			

6.0 SIGNAL TIMING SPECIFICATION

6.1 THE DE Only

< Table 7. Signal Timing Specification >

Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	TBD	TBD	TBD	ns	
	Frequency	-	-	TBD	-	MHz	
Hsync	Period	Th	TBD	TBD	TBD	tCLK	
	Horizontal Valid	Thv	TBD	TBD	TBD	tCLK	
	Horizontal Blank	Thb	TBD	TBD	TBD	tCLK	
	Frequency	fH	TBD	TBD	TBD	KHz	
Vsync	Period	Tv	TBD	TBD	TBD	Th	
	Vertical Valid	Tvd	TBD	TBD	TBD	Th	
	Vertical Blank	Tvb	TBD	TBD	TBD	Th	
	Frequency	fV	TBD	TBD	TBD	Hz	
Receiver clock	Input spread spectrum ratio	SSr	TBD	TBD	TBD	%	

Note : The above is as optimized setting.

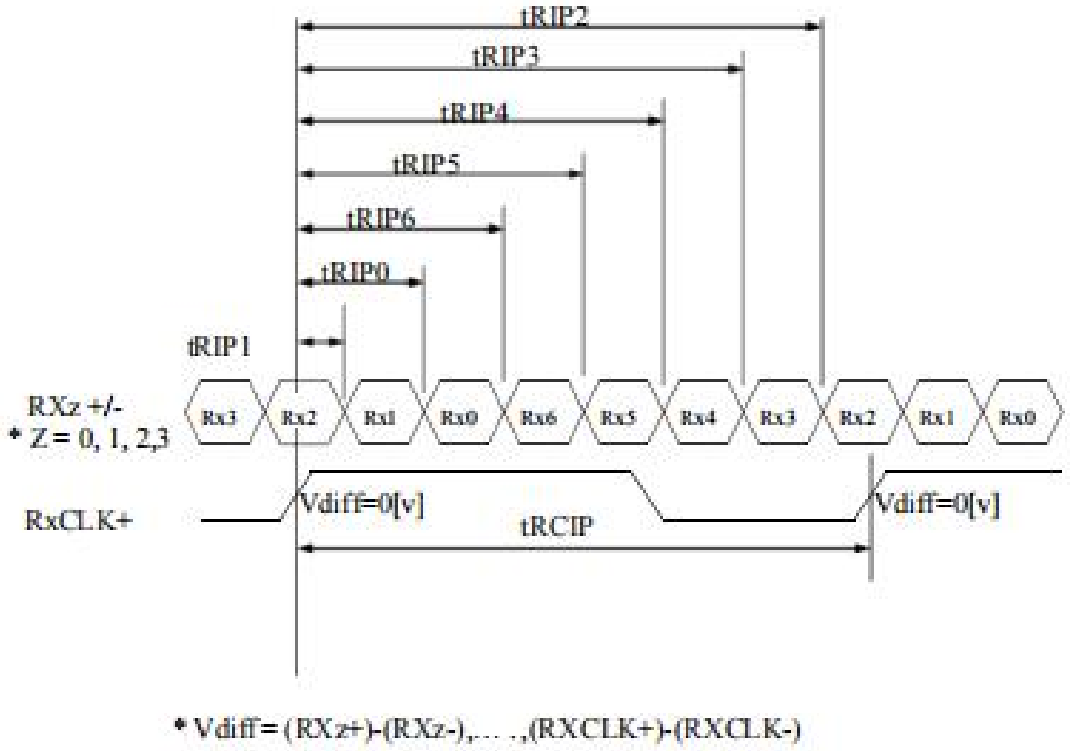
6.0 SIGNAL TIMING SPECIFICATION

6.2 eDP Interface Timing

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

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	TBD	TBD	TBD	nsec	
Input Data 0	tRIP1	TBD	TBD	TBD	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	

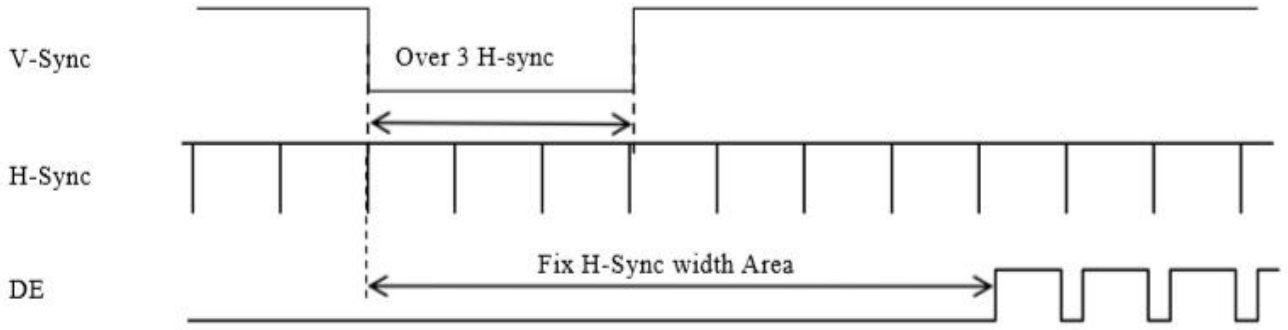
< Table 8. The eDP interface timing parameter



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

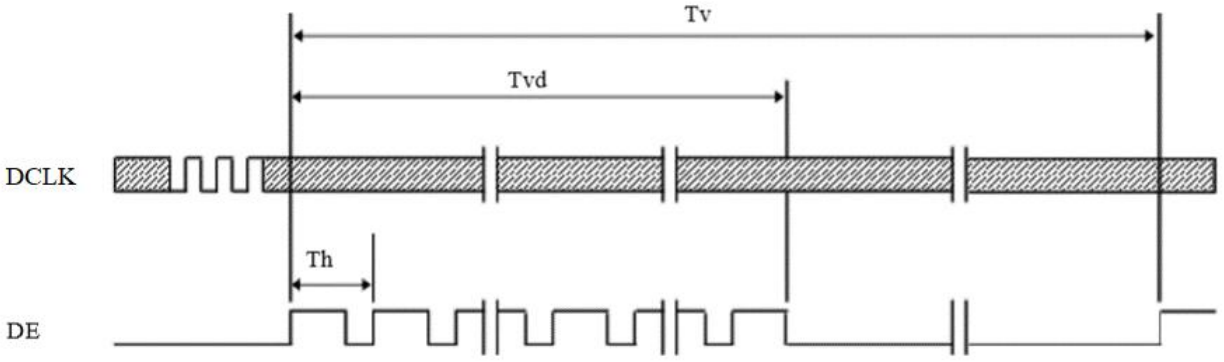
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

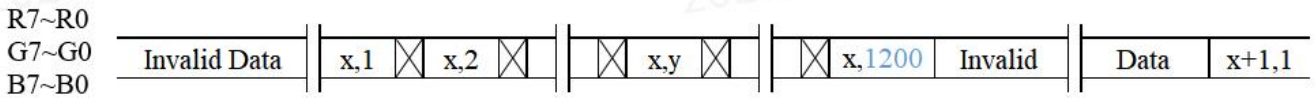
7.1 Sync Timing Waveforms



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

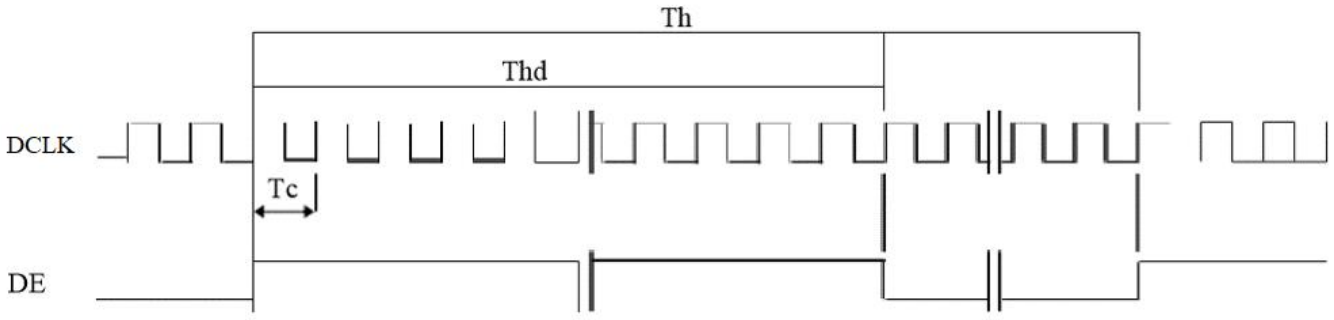
7.2 Vertical Timing Waveforms

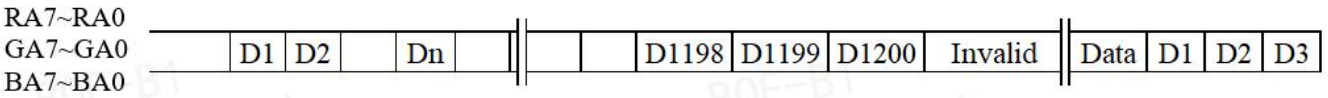


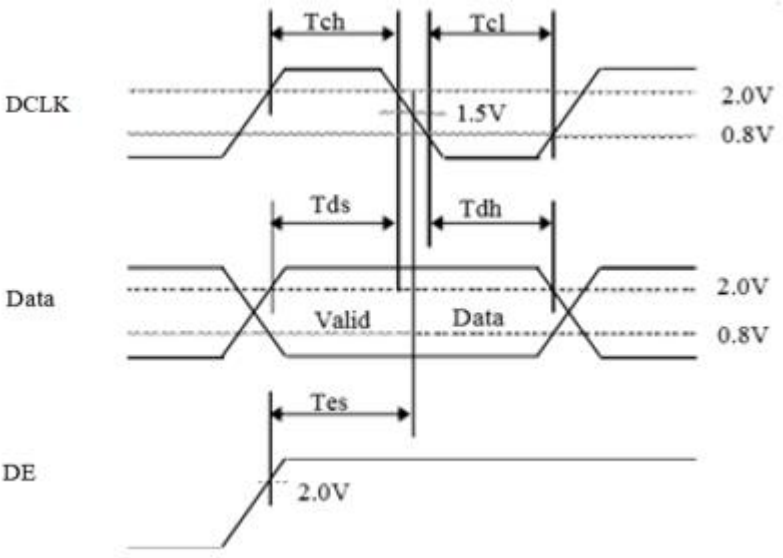


7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.3 Horizontal Timing Waveforms

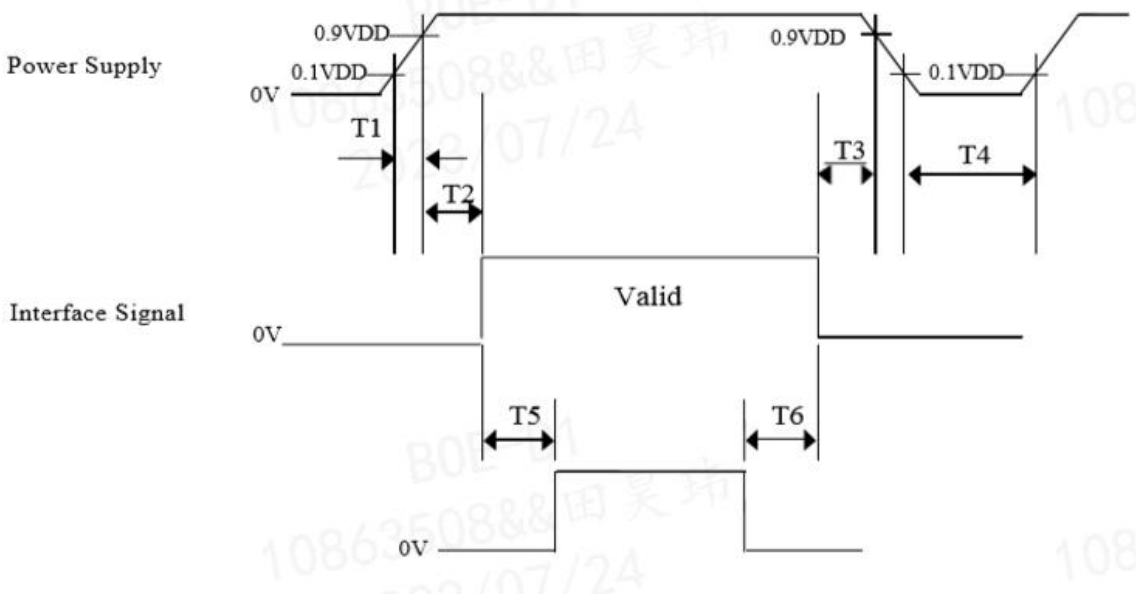






8.0 POWER SEQUENCE

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



Back-light

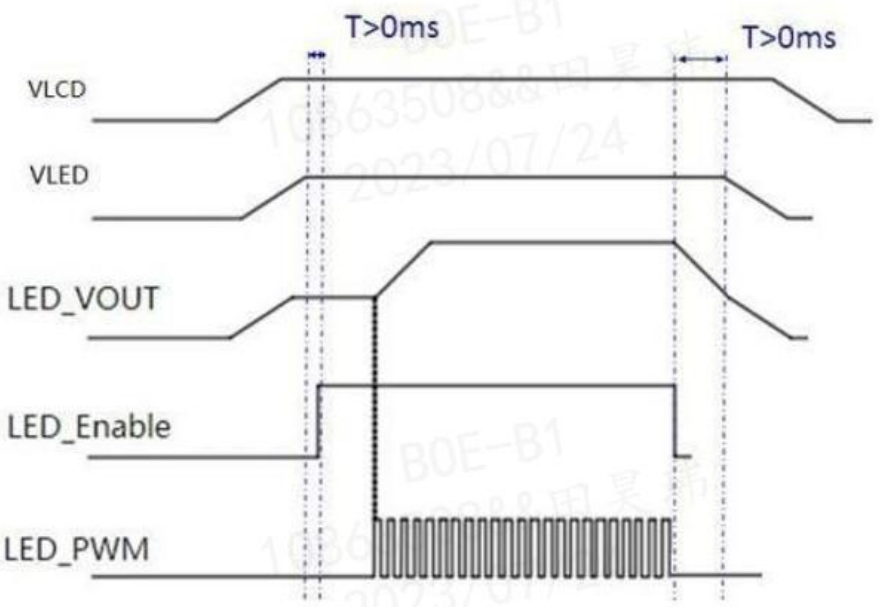
0.5 ms ≤ T1 ≤ 10 ms
0 ≤ T2 ≤ 50 ms
0 < T3 ≤ 50 ms
1 sec ≤ T4
200 ms ≤ T5
200 ms ≤ T6

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

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 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 = -40°C , 240 hrs	
4	High temperature operation test	Ta = 70°C , 240 hrs	
5	Low temperature operation test	Ta = -40°C , 240 hrs	
6	High temperature & high humidity operation test	Ta = 60°C , 90%RH, 240 hrs	
7	High temperature & high humidity storage test	Ta = 85°C , 85%RH, 240 hrs	FOB
8	Thermal shock storage test	Ta = -40 °C ↔ 80 °C (0.5 hr), 100 cycle	
9	Image Sticking	Ta =25℃，Chess 5*5，Switch to L127 gray after lighting 1hr, The positive viewing angle disappears in 5min	
10	Electro-static discharge test (operating)	Air : 150 pF, 330Ω, ±8 KV Contact : 150 pF, 330Ω, ±4 KV Ta = 25°C , 60%RH, Class B	
11	Vibration Test	Frequency 10Hz~55Hz~10Hz Amplitude:0.75mm, X,Y,Zdirection for total 1.5H;(packing condition)	

10.0 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.

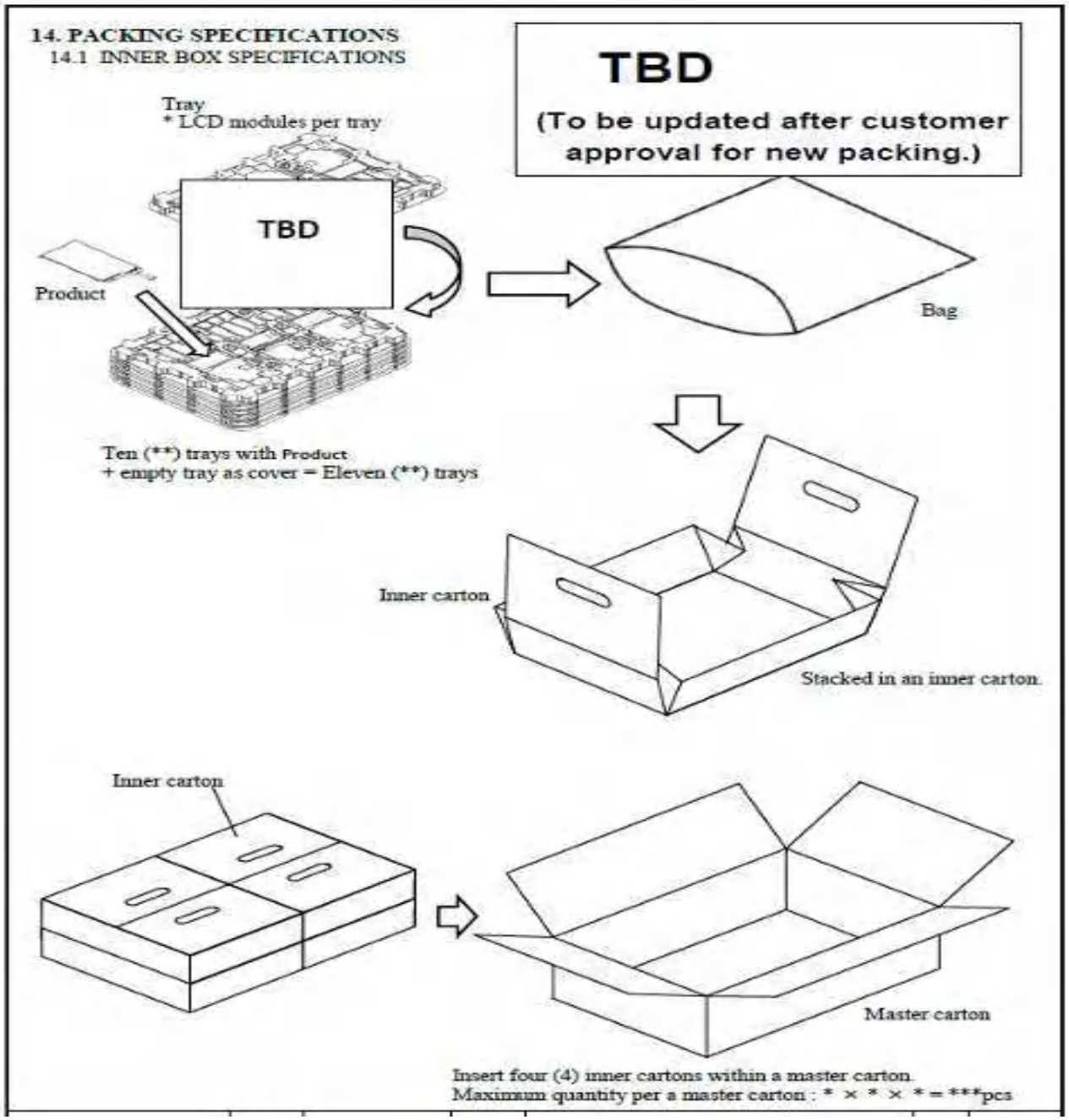
(4) Cautions for the atmosphere
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(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.

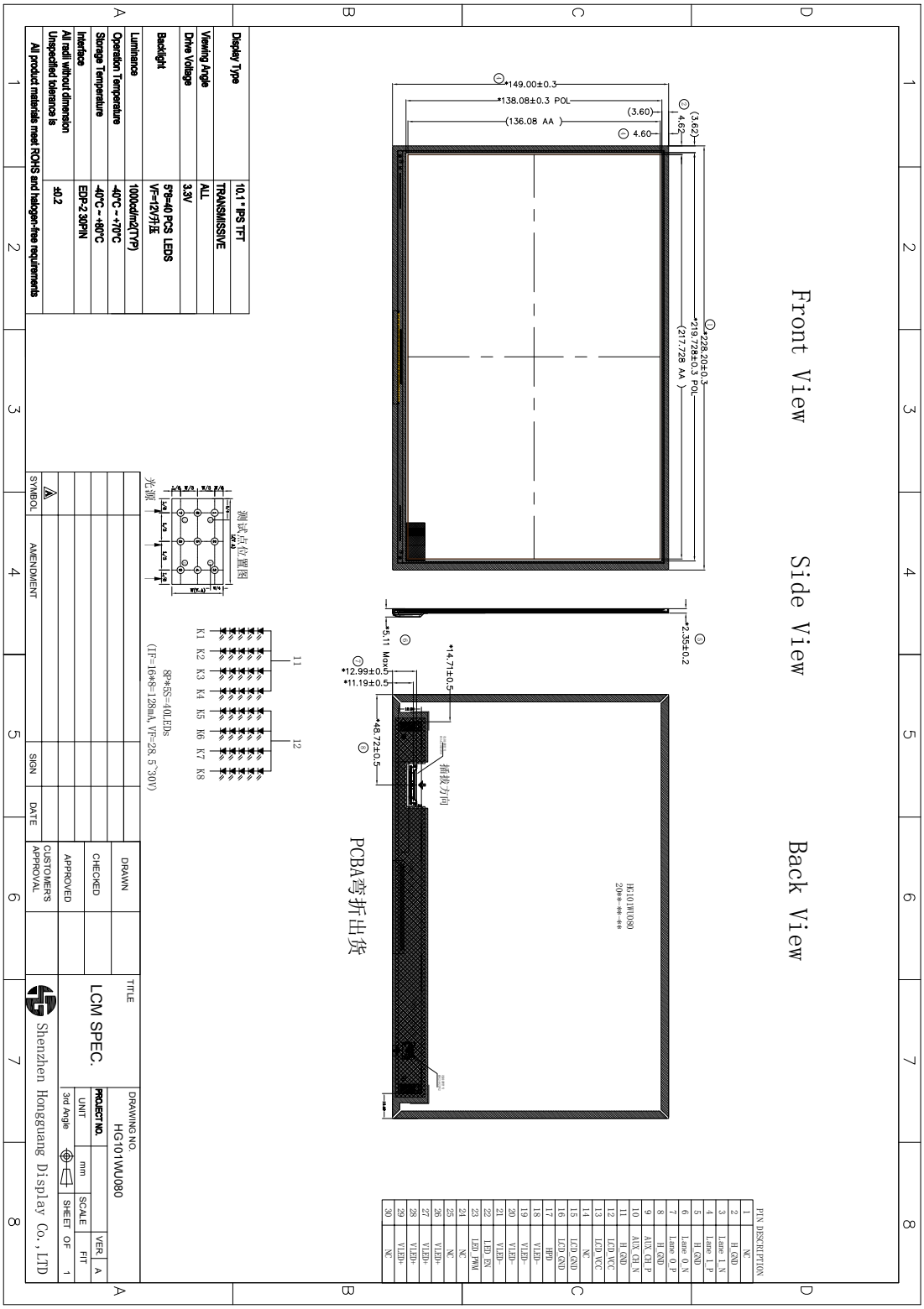
(6) Other cautions
- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc. Please pack the module not to be broken. We recommend to use the original shipping packages.

11.0 PACKING INFORMATION

11.1 Packing Order



12.0 MECHANICAL OUTLINE DIMENSION



Display Type	10.1" IPS TFT
Viewing Angle	TRANSMISSIVE
Drive Voltage	ALL
Backlight	3.3V
Luminance	5*8=40 PCS LEDS VF=12V升压
Operation Temperature	1000cd/m2(TYP)
Storage Temperature	-40°C~+70°C
Interface	-40°C~+80°C
All radii without dimension	EDP-2 30PIN
Unspecified tolerance is	±0.2
All product materials meet ROHS and halogen-free requirements	

PIN	DESCRIPTION
1	NC
2	H_GND
3	Lane0_N
4	Lane0_P
5	H_GND
6	Lane1_N
7	Lane1_P
8	H_GND
9	AUX_CH_P
10	AUX_CH_N
11	H_GND
12	LCD_VCC
13	LCD_VCC
14	NC
15	LCD_GND
16	LCD_GND
17	HPD
18	VLED-
19	VLED-
20	VLED-
21	VLED-
22	LED_EN
23	LED_PWM
24	NC
25	NC
26	VLED+
27	VLED+
28	VLED+
29	VLED+
30	NC

13.0 GENERAL PRECAUTIONS

13.1 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.

13.2 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.

13.3 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,HG is not to be held reliable for the defective operations. It is strongly recommended to contac HG to find out fitness for a particular purpose.

13.4 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.