SPECIFICATION

PRODUCT NO. : TCXD123ABLON-16
VERSION : Ve 1.0
ISSUED DATE : 2021-11-15

This module uses ROHS material

FOR CUSTOMER： _____

□：**APPROVAL FOR SPECIFICATION**
■：**APPROVAL FOR SAMPLE**

DATE	APPROVED BY

Xinli Optoelectronics ：

Presented by	Reviewed by	Organized by
何定川	赵春曉	王俊傑

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1. Record of Revision

Revision	Description	Date
1.0	Initial Release	2021/11/15

1.0 General Descriptions

1.1 Introduction

The TCXD123ABLON-16 is a Color Active Matrix Liquid Crystal Display with a back light system. The matrix uses a-Si Thin Film Transistor as a switching device. This TFT LCD has a 12.3 inch diagonally measured active display area with FHD resolution (1,920 horizontal by 720 vertical pixels array).

1.2 Features

- Supported FHD Resolution
- LVDS Interface
- Wide View Angle
- Compatible with RoHS Standard

1.3 Product Summary

Items	Specifications	Unit
Screen Diagonal	12.3	inch
Active Area (H x V)	292.032 x 109.512	mm
Number of Pixels (H x V)	1,920 x 720	-
Pixel Pitch (H x V)	0.1521 x 0.1521	mm
Pixel Arrangement	R.G.B. Vertical Stripe	-
Display Mode	Normally Black	-
White Luminance	1000 (Typ.)	cd /m^2
Contrast Ratio	1000 (Typ.)	-
Response Time	30 (Max.)@25℃	ms
Input Voltage	3.3 (Typ.)	V
Power Consumption	14.48 (Max.) @ Mosaic, FV=60Hz	W
Weight	380 (Max.)	g
Outline Dimension (H x V x D) With PCBA	299.032 (Typ.) x 123.012 (Typ.) x 8.023 (Max.)	mm
Electrical Interface (Logic)	LVDS	-
Support Color	16.7 M	-
NTSC	75% (Typ.)	%
Optimum Viewing Direction	All O'clock	-
Surface Treatment	HC/3H	-

1.4 Functional Block Diagram

Figure 1 shows the functional block diagram of the LCD module.

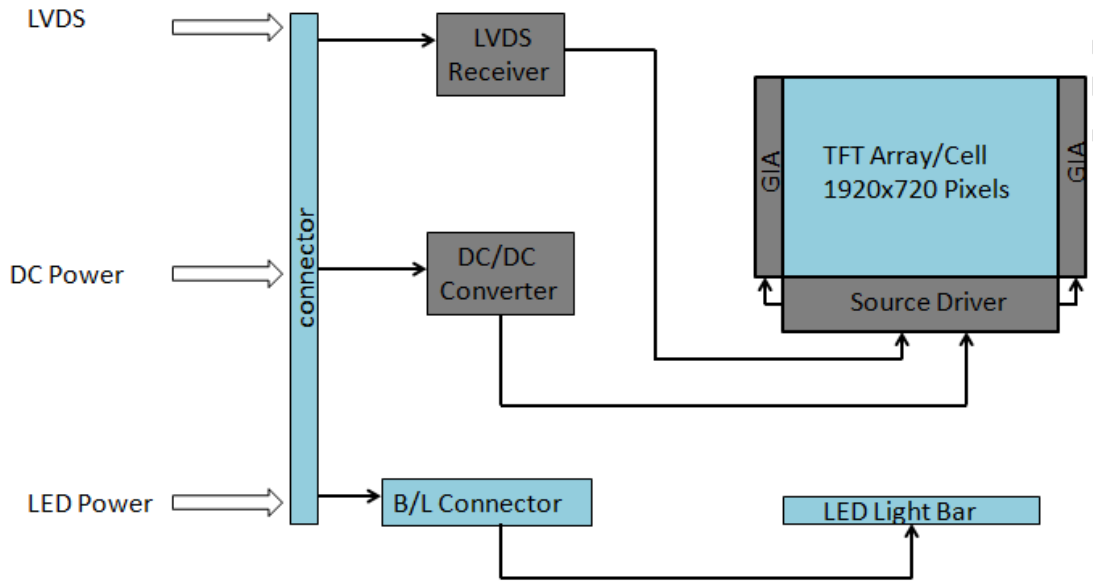


Figure 1 Block Diagram

1.5 Pixel Mapping

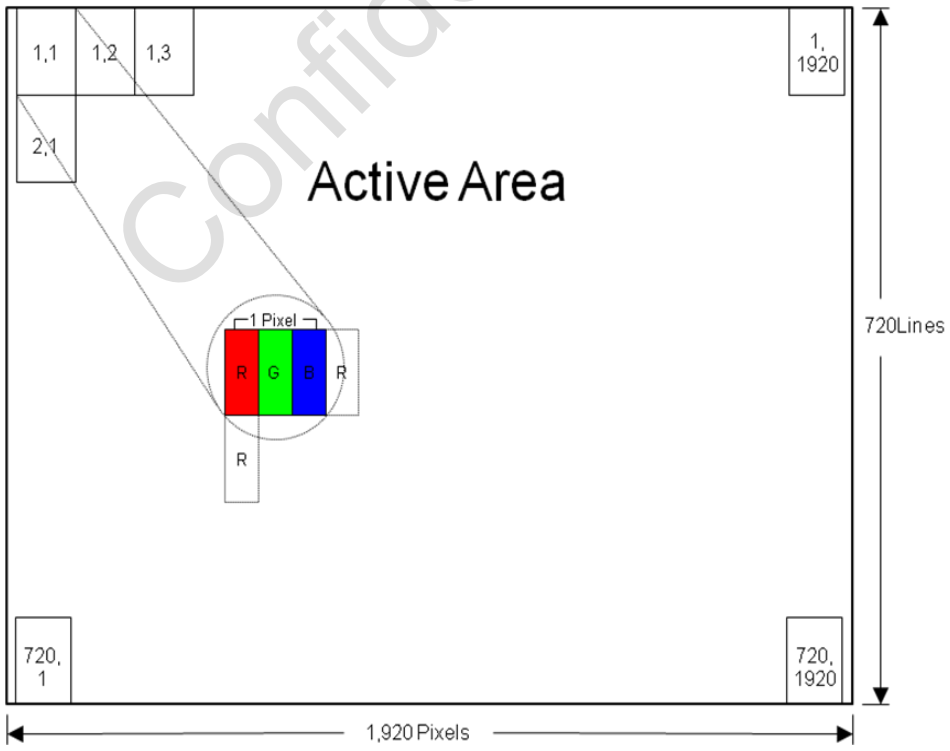


Figure 2 Pixel Mapping

2.0 Absolute Maximum Ratings

Table 1 Electrical & Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	V_{CC}	-0.3	4.0	V	(1),(2),(3),(4)
Logic Input Signal Voltage	V_{Signal}	-0.3	Vcc+0.3	V	
Operating Temperature	T_{gs}	-30	85	℃	
Storage Temperature	T_a	-40	90	℃	

Note (1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded. It is recommended to follow the typical value.

Note (2) All the contents of electro-optical specifications and display fineness are guaranteed under Normal Conditions. All the display fineness should be inspected under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 10%RH.

Note (3) Unpredictable results may occur when it was used in extreme conditions. T_a= Ambient Temperature, T_{gs}= Glass Surface Temperature. All the display fineness should be inspected under normal conditions.

Note (4) Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be lower than 57.8℃, and no condensation of water. Besides, protect the module from static electricity.

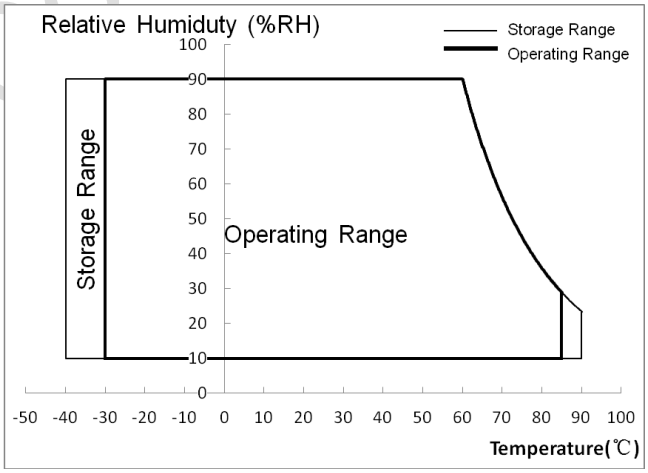


Figure 3 Absolute Ratings of Environment of the LCD Module

3.0 Optical Characteristics

The optical characteristics are measured under stable conditions as following notes.

Table 2 Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle （CR＞10）	Horizontal	θ_{x+}	80	85	-	degree	(1),(2),(3),(4)(8)
		θ_{x-}	80	85	-		
	Vertical	θ_{y+}	80	85	-		
		θ_{y-}	80	85	-		
Contrast Ratio	Center		800	1000	-	-	(1),(2),(4),(8) θx=θy=0°
Response Time T=25℃	Rising + Falling		-	25	30	ms	(1),(2),(5),(8) θx=θy=0°
Response Time T=-20℃			-	170	250	ms	
Response Time T=-30℃			-	360	450	ms	
Color Chromaticity (CIE1931)	Red x		Typ. -0.04	0.621	Typ. +0.04	-	(1),(2),(3),(8) θx=θy=0°
	Red y			0.313		-	
	Green x			0.304		-	
	Green y			0.650		-	
	Blue x			0.157		-	
	Blue y			0.054		-	
	White x			0.300		-	
	White y			0.320		-	
NTSC	-		70	75	-	%	(1),(2),(3),(8) θx=θy=0°
White Luminance	Center Point		800	1000	-	cd/m^2	(1),(2),(6),(8) θx=θy=0°
Luminance Uniformity	9 Points@white		70	80	-	%	(1),(2),(7),(8) θx=θy=0°
	9 Points@black		50	60	-		

Note (1) Measurement Setup:

The LCD module should be stabilized at given ambient temperature (25℃) for 30 minutes to avoid abrupt temperature changing during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 30 minutes in the windless room.

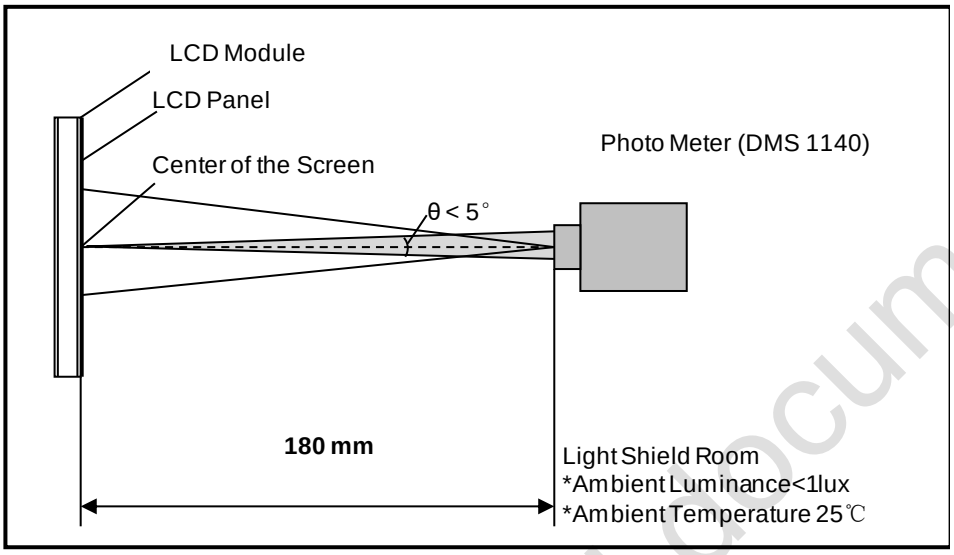


Figure 4 Measurement Setup

Note (2) The LED input parameter setting as:

I_{LED}:360 mA

Note (3) Definition of Viewing Angle

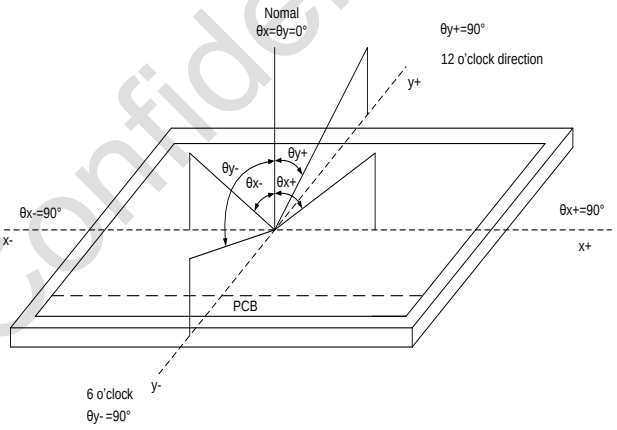


Figure 5 Definition of Viewing Angle

Note (4) Definition of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression:

Contrast Ratio (CR) = The luminance of White pattern/ The luminance of Black pattern

Note (5) Definition of Response Time (T_R, T_F)

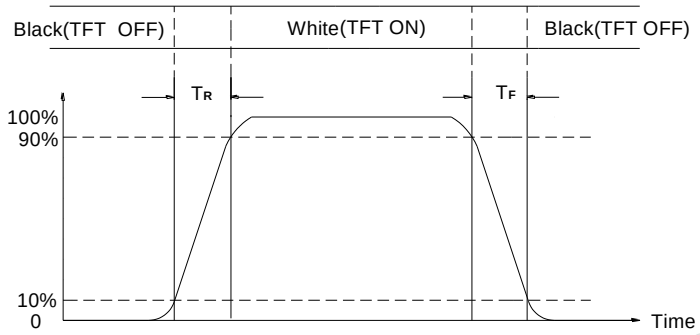


Figure 6 Definition of Response Time

Note (6) Definition of Luminance of White

Measure the luminance of White pattern (Ref.: Active Area)

Display Luminance=L1（center point）

H—Active Area Width, V—Active Area Height, L—Luminance

Note (7) Definition of Luminance Uniformity (Ref.: Active Area)

Measure the luminance of White pattern at X points.

Luminance Uniformity= Min.(L1, L2, ... L9) / Max.(L1, L2, ... L9)

H—Active Area Width, V—Active Area Height, L—Luminance

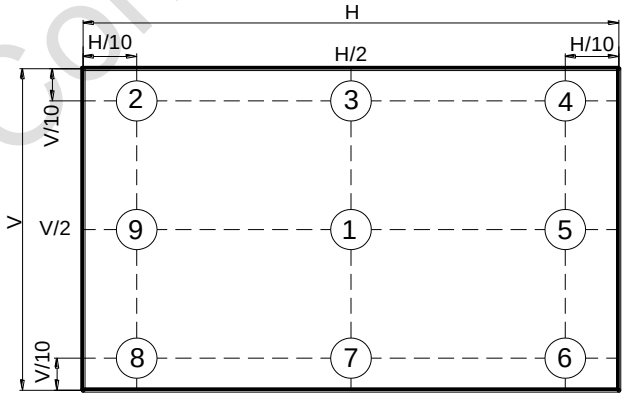


Figure 7 Measurement Locations of 9 Points

Note (8) All optical data are based on XL given system & nominal parameter & testing machine in this document.

4.0 Electrical Characteristics

4.1 Interface Connector

Table 3 Signal Connector Type

Item	Description
Manufacturer / Type	BJD-101049-205050

Table 4 Signal Connector Pin Assignment

Pin No.	Symbol	Description	Remarks
1	GND	Digital ground	-
2	BIST	LCD Panel Self Test Enable, When it is not used, connecting to GND is recommended, don't floating	Active as 3.3V
3	VCC	Digital Power/Vin =3.3V	-
4	VCC	Digital Power/Vin =3.3V	-
5	GND	Power ground	-
6	GND	Power ground	-
7	OTP	Serial interface OTP power	(1) 8.6V
8	NC	No connection	-
9	GND	Power ground	-
10	ORXIN0-	Negative LVDS differential data input(Odd data)	-
11	ORXIN0+	Positive LVDS differential data input(Odd data)	-
12	ORXIN1-	Negative LVDS differential data input(Odd data)	-
13	ORXIN1+	Positive LVDS differential data input(Odd data)	-
14	ORXIN2-	Negative LVDS differential data input(Odd data)	-
15	ORXIN2+	Positive LVDS differential data input(Odd data)	-
16	ORXCLKIN-	Negative LVDS differential data input(Odd clock)	-
17	ORXCLKIN+	Positive LVDS differential data input(Odd clock)	-
18	ORXIN3-	Negative LVDS differential data input(Odd data)	-

19	ORXIN3+	Positive LVDS differential data input(Odd data)	-
20	ERXIN0-	Negative LVDS differential data input(Even data)	-
21	ERXIN0+	Positive LVDS differential data input(Even data)	-
22	ERXIN1-	Negative LVDS differential data input(Even data)	-
23	ERXIN1+	Positive LVDS differential data input(Even data)	-
24	ERXIN2-	Negative LVDS differential data input(Even data)	-
25	ERXIN2+	Positive LVDS differential data input(Even data)	-
26	ERXCLKIN-	Negative LVDS differential data input(Even clock)	-
27	ERXCLKIN+	Positive LVDS differential data input(Even clock)	-
28	ERXIN3-	Negative LVDS differential data input(Even data)	-
29	ERXIN3+	Positive LVDS differential data input(Even data)	-
30	GND	Power ground	-
31	FAULT	FAULT signal output(normal=H,abnormal=L)	-
32	RESET	Global reset pin,active High.	-
33	STBYB	Standby mode,active High.	-
34	CSB	Serial interface chip enable	(1)
35	SCL	Serial interface clock input	
36	SDAI	Serial interface data input	
37	SDAO	Serial interface data output.	
38	GND	Power ground	-
39	GND	Power ground	-
40	NC	No connection	-
41	LEDA	LED power(Anode)	36.3V
42	LEDA	LED power(Anode)	
43	LEDA	LED power(Anode)	
44	NC	No connection	-

45	LEDK	Cathode1	90mA
46	LEDK	Cathode2	90mA
47	LEDK	Cathode3	90mA
48	LEDK	Cathode4	90mA
49	NTC_A	NTC_Anode	-
50	NTC_K	NTC_Cathode	-

Note(1)：Pin 7, 34 - 37 only for XL use, NC is recommended.

4.2 Signal Electrical Characteristics

4.2.1 Signal Electrical Characteristics for LVDS Receiver

The built-in LVDS receiver is compatible with (ANSI/TIA/TIA-644) standard.

Table 5 LVDS Receiver Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	Vth	+150	-	-	mV	V_{CM}=+1.2V
Differential Input Low Threshold	Vtl	-	-	-150	mV	-
Magnitude Differential Input	$\|V_{ID}\|$	150	-	600	mV	-
LVDS Input Voltage	V_{INLV}	0.7	-	1.7	V	-
Common Mode Voltage	V_{CM}	1.0	1.2	1.7-|VID|/2	V	-

Note (1) Input signals shall be low or Hi- resistance state when VCC is off.

Note (2) All electrical characteristics for LVDS signal are defined and shall be measured at the interface connector of LCD.

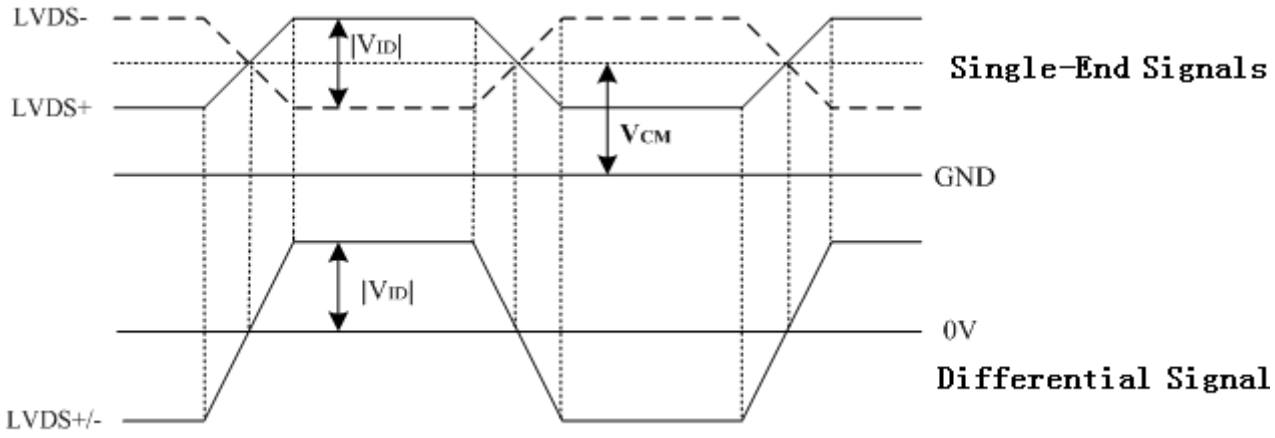


Figure 8 Voltage Definitions

Table 6 LVDS mode AC electrical characterisitics

Parameter	Symbol	Spec			Unit
		Min	Typ	Max	
Clock frequency(1-port)	Flvcyc	40.8	-	48.2	MHz
Clock period(1-port)	Tlvcyc	20.7	-	-	ns
1 data bit time	UI	-	1/7	-	Tlvcyc
Clock high time	TLVHW	-	4	-	UI
Clock low time	TLVLW	-	3	-	UI
Position1	Tpos1	-0.2	0	0.2	UI
Position0	Tpos0	0.8	1	1.2	UI
Position6	Tpos6	1.8	2	2.2	UI
Position5	Tpos5	2.8	3	3.2	UI
Position4	Tpos4	3.8	4	4.2	UI
Position3	Tpos3	4.8	5	5.2	UI
Position2	Tpos2	5.8	6	6.2	UI
Input eye width	TEYEW	0.6	-	-	UI
Input eye border	TEX	-	-	0.2	UI
LVDS clock to clock skew	TSKEW_EO	-1	-	1	UI

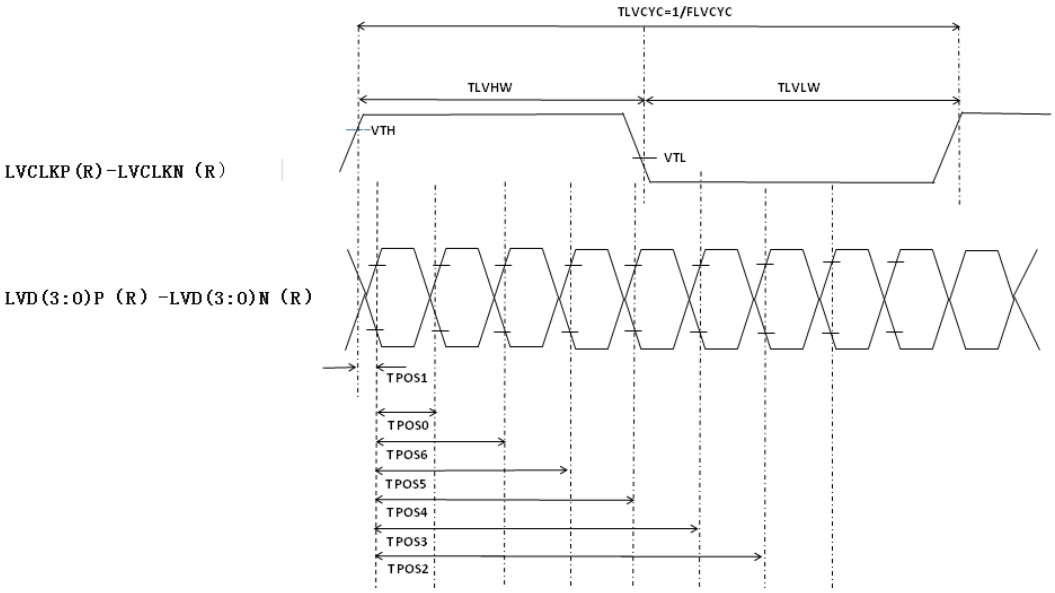


Figure 9 LVDS input timing

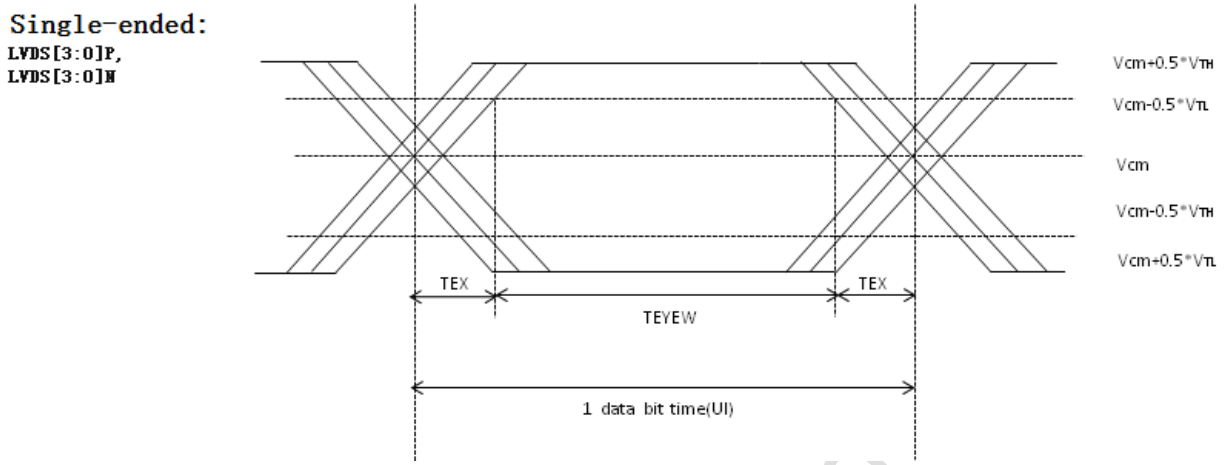


Figure 10 LVDS input eye diagram

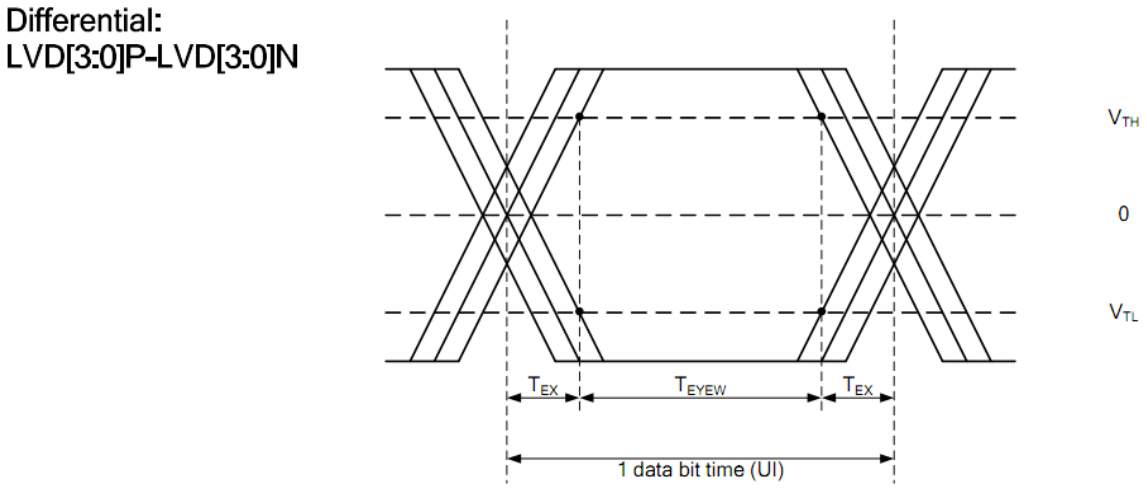


Figure 11 LVDS input eye diagram

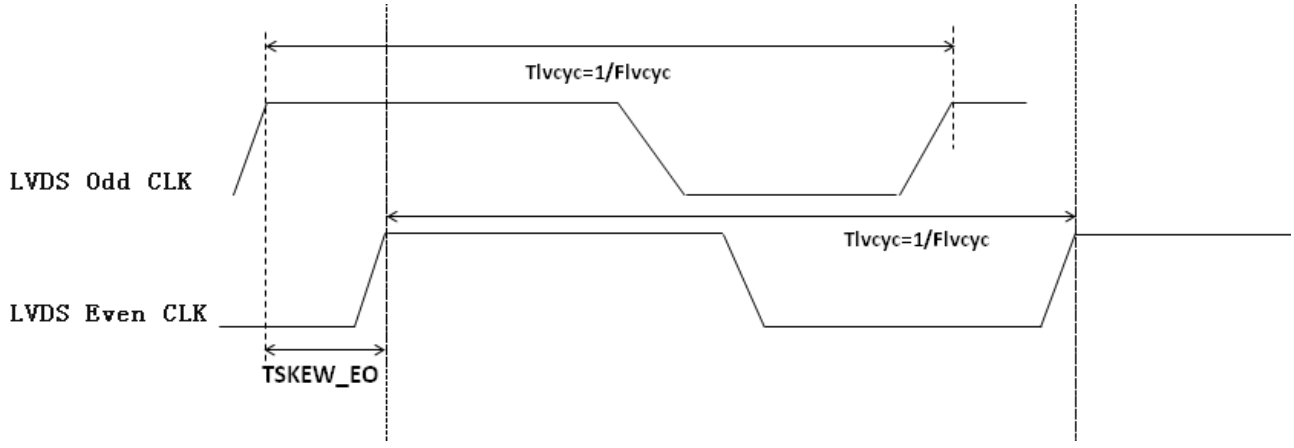


Figure 12 LVDS clock to clock skew

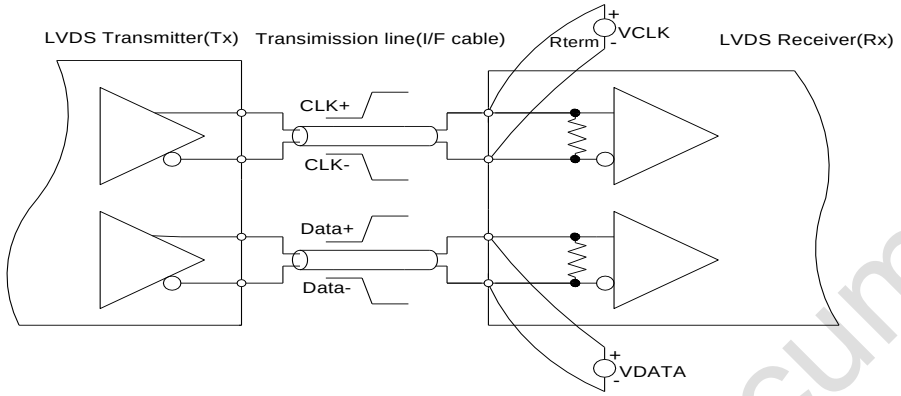


Figure 13 Measurement System

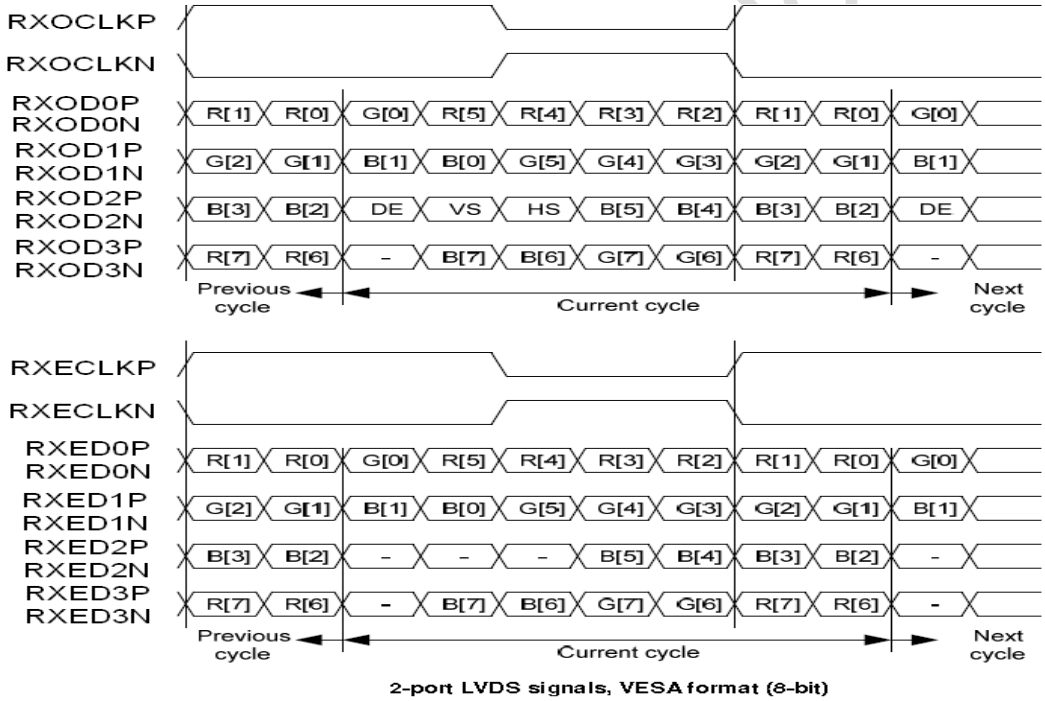


Figure 14 Data Mapping

4.2.2 LVDS Receiver Internal Circuit

Figure 15 shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link.

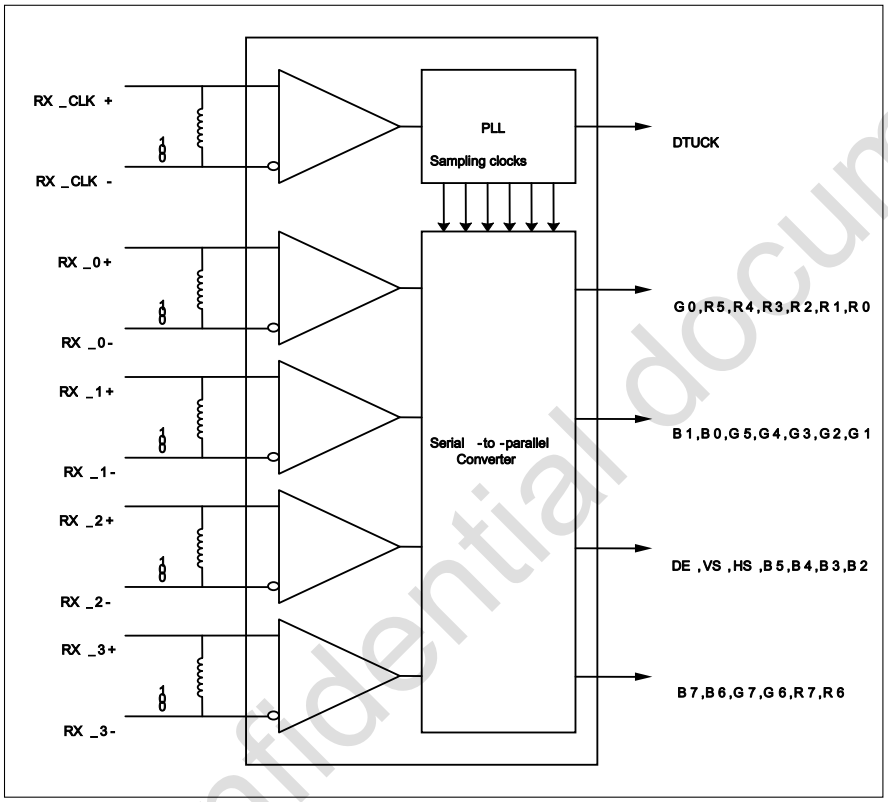


Figure 15 LVDS Receiver Internal Circuit

4.3 Interface Timings

Table 7 Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
LVDS Clock Frequency	Fclk	81.6	89.0	96.5	MHz
H Total Time	HT	1,975	2030	2880	Clocks
H Active Time	HA		1920		Clocks
V Total Time	VT	728	731	1080	Lines
V Active Time	VA		720		Lines
Frame Rate	FV	55	60	65	Hz

Note1:This module actually uses 2-port.

Note2: HT * VT *Frame Frequency≤48.25MHz（1-port）.

Note3: All reliabilities are specified for timing specification based on refresh rate of 60Hz.

DE Only Mode

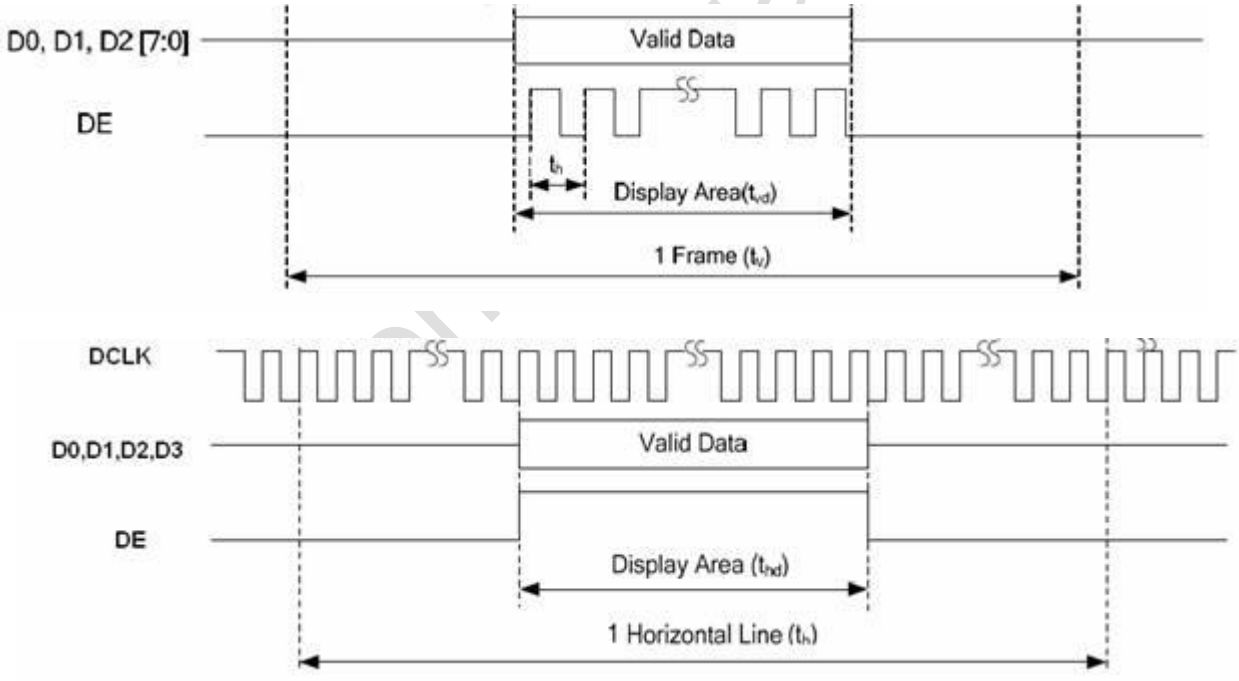


Figure 16 Timing Diagram

4.4 Input Power Specifications

Input power specifications are as follows.

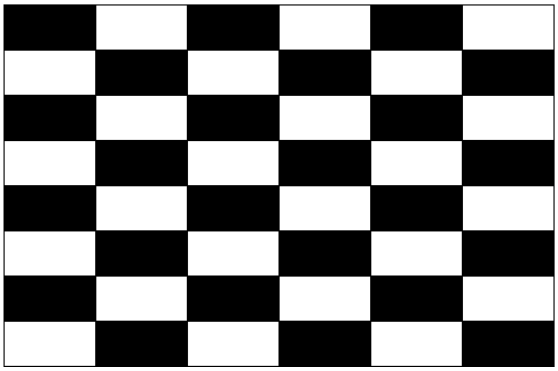
Table 8 Input Power Specifications

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
System Power Supply							
Power Supply Input Voltage		V_{CC}	3.0	3.3	3.6	V	(1),(2)
Power Supply Input Current	Mosaic	I_{cc}	-	-	460	mA	(1),(3)
PCC Power Consumption	Mosaic	P_{CC}	-	-	1.38	W	
Logic Input Signal	High level voltage	V_{IH}	3.0	-	3.6	V	(1)
	Low level voltage	V_{IL}	0	-	0.4	V	
Logic Output Signal	High level voltage	V_{OH}	3.0	-	3.6	V	(1)
	Low level voltage	V_{OL}	0	-	0.5	V	
Rush Current		I_{Rush}	-	-	1500	mA	(1),(4)
Allowable Logic/LCD Drive Ripple Voltage		V_{VCC-RP}	-	-	200	mV	(1)
LED Power Supply							
LED Input Voltage		V_{LED}	-	-	36.3	V	(1),(2),(7)
LED Power Consumption		P_{LED}	-	-	13.1	W	(1),(7)
LED Forward Voltage		V_F	-	-	3.3	V	(1),(2),(8)
LED Forward Current		I_F	-	90	-	mA	
LED Life Time		LT	30,000	-	-	Hours	(1),(6)

Note (1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 10%RH.

Note (2) All of the absolute maximum ratings specified in the table, if exceeded, may cause faulty operation or unrecoverable damage. It is recommended to follow the typical value.

Note (3) The specified V_{CC} current and power consumption are measured under the V_{CC} = 3.3 V, FV= 60 Hz condition and Mosaic pattern.



Note (4) The figures below is the measuring condition of V_{CC}. Rush current can be measured when T_{RUSH} is 0.5 ms.

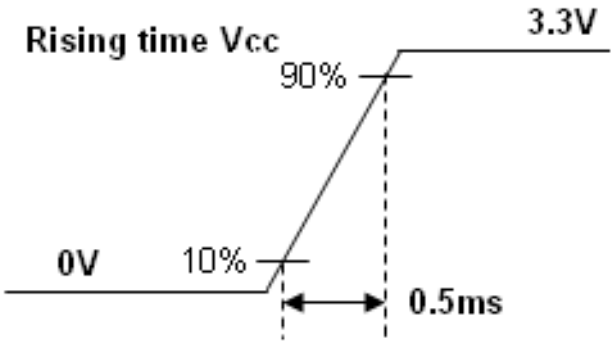


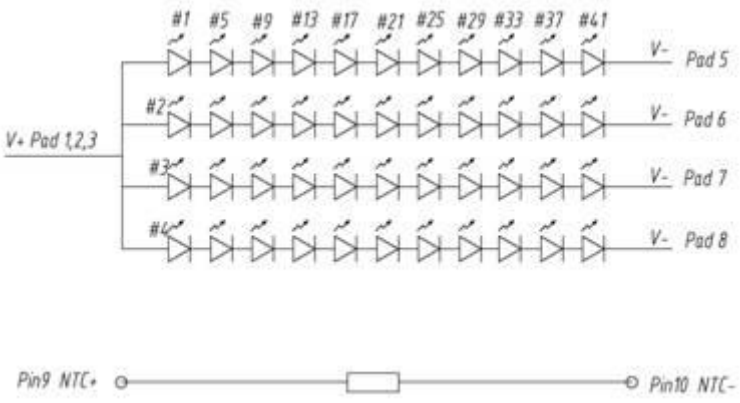
Figure 17 VCC Rising Time

Note (5) Although acceptable range as defined, the dimming ratio is not effective at all conditions. The PWM frequency should be fixed and stable for more consistent luminance control at any specific level desired.

Note (6) The life time is determined as the sum of the lighting time till the luminance of LCD at the typical LED current reducing to 50% of the minimum value under normal operating condition.

Note (7) Definition of VLED and PLED

$V_{LED} = V_F \times 11$, $I_{LED} = I_F \times 4$, PLED = $V_{LED} \times I_{LED}$



Note (8) The allowable forward current of LED vary with environmental temperature：

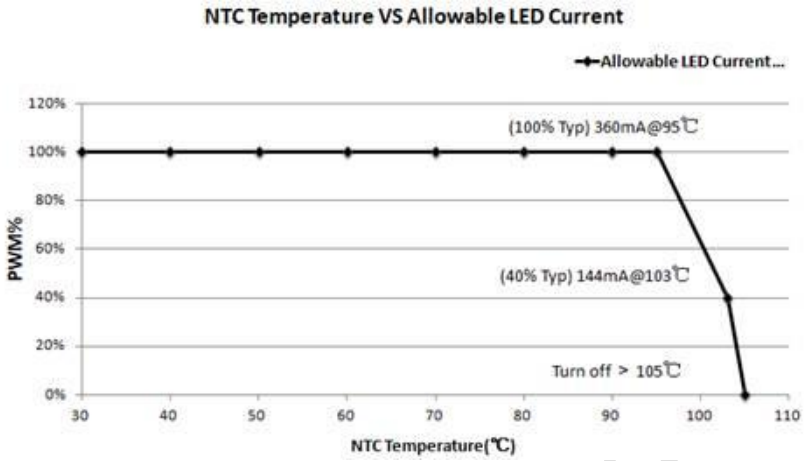


Figure 18 Backlight Current De-rating Curve

Note (9) The relationship of temperature and resistance for NTC:

Temperature/℃	Resistance/Kohm	Temperature/℃	Resistance/Kohm
-40	195.652	60	3.014
-35	148.171	65	2.586
-30	113.347	70	2.228
-25	87.559	75	1.925
-20	68.237	80	1.669
-15	53.650	85	1.452
-10	42.506	90	1.268
-5	33.892	95	1.110
0	27.219	100	0.974
5	22.021	105	0.858
10	17.926	110	0.758
15	14.674	115	0.672
20	12.081	120	0.596
25	10.000	125	0.531
30	8.315	130	0.474
35	6.948	135	0.424
40	5.834	140	0.381
45	4.917	145	0.342
50	4.161	150	0.309
55	3.535		

4.5 Power ON/OFF Sequence

1.Interface signals are also shown in the chart. Signals from any system shall be Hi-resistance state or low level when VCC voltage is off.

2. When system first start up, should keep the VCC high time longer than 200ms, otherwise may cause image sticking when VCC drop off.

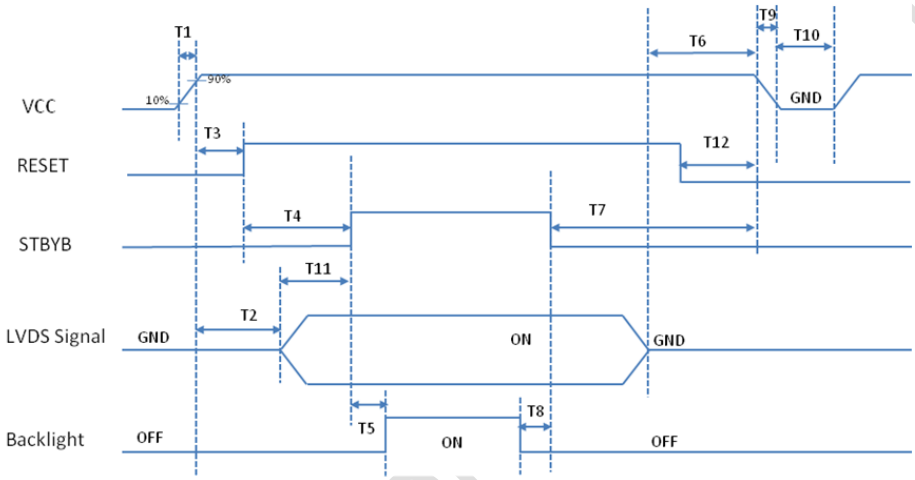


Figure 19 Power Sequence

Table 9 Power Sequencing Requirements

Parameter	Symbol	Unit	Min.	Typ.	Max.
VCC Rising Time	T1	ms	0.5	-	10
VCC to LVDS	T2	ms	0	-	50
VCC to RSTB	T3	us	10	-	-
RSTB to STBYB pull H	T4	ms	36	-	-
STBYB pull H to BL power On	T5	ms	200	-	-
BL power off to STBYB pull L	T8	ms	200	-	-
STBYB pull L to VCC Power off	T7	ms	50	67	83
LVDS Disable to VCC Power off	T6	ms	0	26	50
VCC Fall Time	T9	ms	0.5	-	30
VCC Power off	T10	s	0.5	14.2	-
LVDS Enable to STBYB pull high	T11	ms	0	10	-
RSTB pull high to BIST pull high	T12	ms	10	-	-

Note: XL recommend T6, T7, T10, T11 to setting Typical value. There will be unknown risks if not.

5.0 Mechanical Characteristics

5.1 Outline Drawing

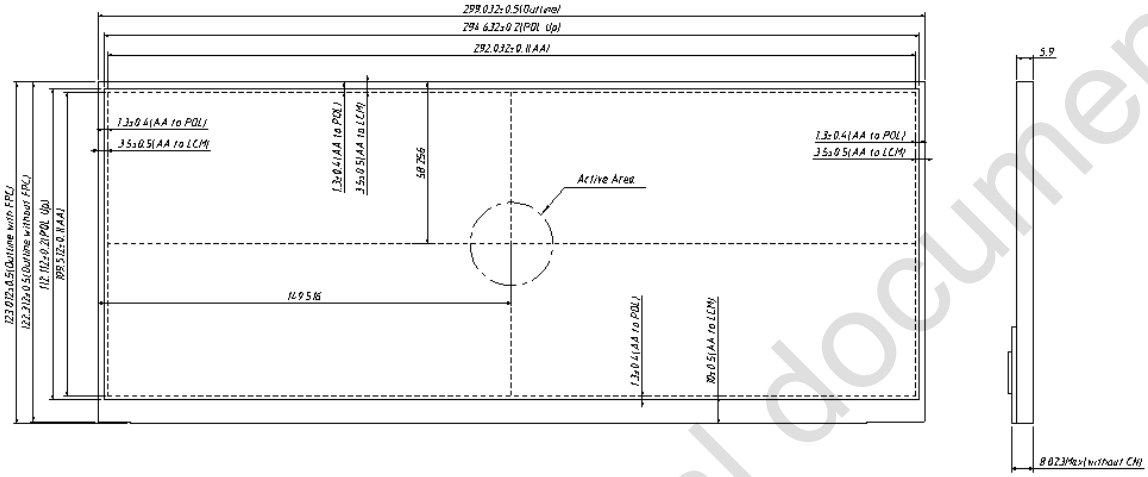
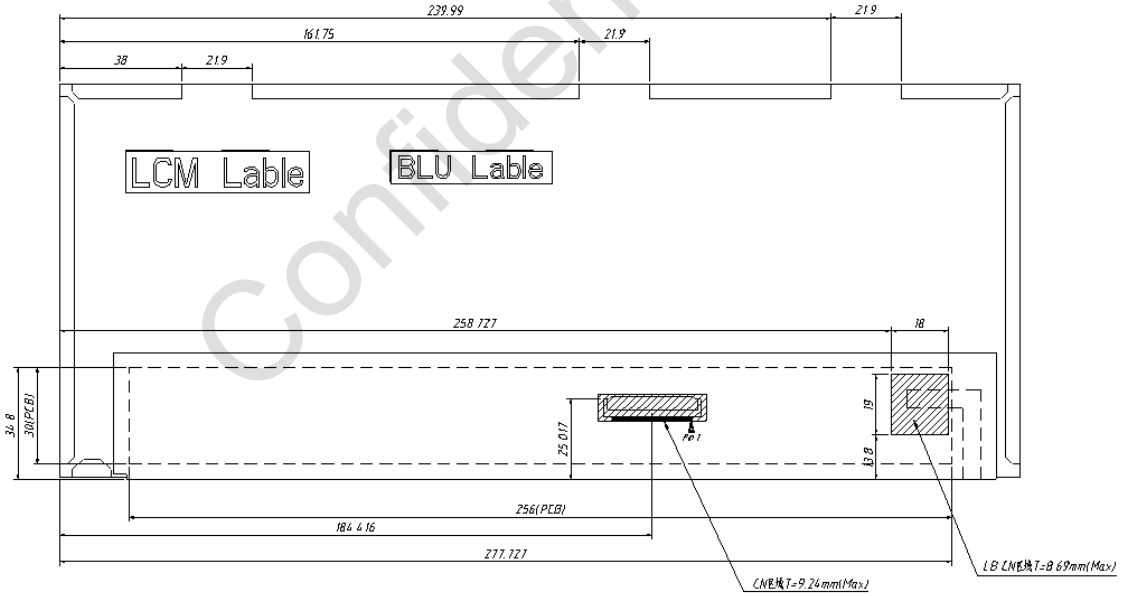


Figure 20 Reference Outline Drawing (Front Side)



Notes：Unmarked tolerance±0.5

Figure 21 Reference Outline Drawing (Back Side)

5.2 Dimension Specifications

Table 10 Module Dimension Specifications

Item		Min.	Typ.	Max.	Unit
Width		298.532	299.032	299.532	mm
Height		122.512	123.012	123.512	mm
Thickness	With PCBA	-	-	8.023	mm
Weight		-	348.5	380	g

Note：Outline dimension measure instrument: Vernier Caliper.

6.0 Reliability Conditions

Table 11 Reliability Condition

Item		Package	Test Conditions		Note
High Temperature/High Humidity Operating Test		Module	T_{gs}=60℃, 90%RH, 500 hours		(1),(2),(3),(4),(7)
High Temperature Operating Test		Module	T_{gs}=85℃, 500 hours		
Low Temperature Operating Test		Module	T_a=-30℃, 500 hours		
High Temperature Storage Test		Module	T_a=90℃, 500 hours		(1),(3),(4)
Low Temperature Storage Test		Module	T_a=-40℃, 500 hours		
Shock Non-operating Test		Module	100G,6ms,sin wave,±XYZ×3times,Total 18times		(1),(3),(5)
Vibration Non-operating Test		Module	half-sine Frequency: 8Hz ~ 33Hz Stroke: 1.3mm Sweep: 2.9G 33.3Hz ~ 400Hz X,Z Cycle : 15 minutes 2 hrs for each direction of X,Z ; 4 hours for Y direction		
ESD Test	Operating	Module	Contact	±8KV, 150 pF,R=330Ω	(1),(2),(6)
			Air	±15KV, 150pF, R=330Ω	

Note (1) A sample can only have one test. Outward appearance, image quality and optical data can only be checked at normal conditions according to the XL document before reliable test. Only check the function of the module after reliability test.

Note (2) The setting of electrical parameters should follow the typical value before reliability test.

Note (3) During the test, it is unaccepted to have condensate water remains. Besides, protect the module from static electricity.

Note (4) The sample must be released for 24 hours under normal conditions before judging. Furthermore, all the judgment must be made under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 10%RH. T_a= Ambient Temperature, T_{gs}= Glass Surface Temperature.

Note (5) The module should be fixed firmly in order to avoid twisting and bending.

Note (6) It could be regarded as pass, when the module recovers from function fault caused by ESD after resetting.

Note (7) LED forward current should follow the current of LED vary with environmental temperature. (Figure 18 Backlight De-rating Curve)

7.0 Package Specification

TBD

8.0 Lot Mark

8.1 Module label

TBD

8.2 Carton label

TBD

9.0 General Precaution

9.1 Using Restriction

This product is not authorized for using in life supporting systems, aircraft navigation control systems, military systems and any other appliance where performance failure could be life-threatening or lead to be catastrophic.

9.2 Operation Precaution

(1)The LCD product should be operated under normal conditions.
Normal conditions are defined as below:

Temperature: 25℃

Humidity: 55±10%

Display pattern: continually changing pattern (Not stationary)

(2) Brightness and response time depend on the temperature. (It needs more time to reach normal brightness in low temperature.)

(3) It is necessary for you to pay attention to condensation when the ambient temperature drops suddenly. Condensate water would damage the polarizer and electrical contacted parts of the module. Besides, smear or spot will remain after condensate water evaporating.

(4) If the absolute maximum rating value was exceeded, it may damage the module.

(5) Do not adjust the variable resistor located on the module.

(6) Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding may be important to minimize the interference.

(7) Image sticking may occur when the module displayed the same pattern for long time.

(8) Do not connect or disconnect the module in the “power on” condition. Power supply should always be turned on/off by the “power on/off sequence”

(9) Ultra-violet ray filter is necessary for outdoor operation.

9.3 Mounting Precaution

(1) All the operators should be electrically grounded and with Ion-blown equipment turning on when mounting or handling. Dressing finger-stalls out of the gloves is important for keeping the panel clean during the incoming inspection and the process of assembly.

(2) It is unacceptable that the material of cover case contains acetic or chloric. Besides, any other material that could generate corrosive gas or cause circuit break by electro-chemical reaction is not desirable.

(3) The case on which a module is mounted should have sufficient strength so that external force is not transmitted to the module directly.

(4) It is obvious that you should adopt radiation structure to satisfy the temperature specification.

(5) So as to acquire higher luminance, the cable of the power supply should be connected directly with a minimize length.

(6) It should be attached to the system tightly by using all holes for mounting, when the module is

assembled. Be careful not to apply uneven force to the module，especially to the PCB on the back.
(7) A transparent protective film needs to be attached to the surface of the module.
(8) Do not press or scratch the polarizer exposed with anything harder than HB pencil lead. In addition, don't touch the pin exposed with bare hands directly.
(9) Clean the polarizer gently with absorbent cotton or soft cloth when it is dirty.
(10) Wipe off saliva or water droplet as soon as possible. Otherwise, it may cause deformation and fading of color.
(11)Clean the panel gently with absorbent cotton or soft cloth when it is dirty. Ethanol(C_2H_5OH) is allowed to be used. Ketone (ex. Acetone), Toluene, Ethyl acid, Methyl chloride, etc are not allowed to be used for cleaning the panel, which might react with the polarizer to cause permanent damage.
(12) Do not disassemble or modify the module. It may damage sensitive parts in the LCD module, and cause scratches or dust remains. XLdoes not warrant the module, if you disassemble or modify the module.

9.4 Handling Precaution

(1) Static electricity will generate between the film and polarizer, when the protection film is peeled off. It should be peeled off slowly and carefully by operators who are electrically grounded and with Ion-blown equipment turning on. Besides, it is recommended to peel off the film from the bonding area.
(2) The protection film is attached to the polarizer with a small amount of glue. When the module with protection film attached is stored for a long time, a little glue may remain after peeling.
(3) If the liquid crystal material leaks from the panel, keep it away from the eyes and mouth. In case of contact with hands, legs or clothes, it must be clean with soap thoroughly.

9.5 Storage Precaution

When storing modules as spares for long time, the following precautions must be executed.
(1) Store them in a dark place. Do not expose to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.
(2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
(3) It is recommended to use it in a short-time period, after it's unpacked. Otherwise, we would not guarantee the quality.

9.6 Others

When disposing LCD module, obey the local environmental regulations.