Document Title	PV94500QXT40A Tentative Product Specification			Page No.	1/26
Document No.		Issue date	2019/05/06	Revision	00

Tentative Product Specification

To:

Product Name: PV94500QXT40A

Document Issue Date: 2019/05/06

Customer	
SIGNATURE _____ _____ _____ Please return 1 copy for your confirmation with your signature and comments.	**SIGNATURE** **REVIEWED BY CQM** _____ **PREPARED BY FAE** _____

Add: 2nd Floor, Building C, Jia Huang Yuan Technical Park, Tiegang, Xixiang, Bao'an District, Shenzhen city, Guangdong province, P.R.China 518126.
E-mail: Helen@kingtechgroup.cn TEL: 86-755- 23037763 Mobile: +86-139-2528-0716 Web: www.kingtechgroup.cn

Revision	Date	Page	Revised Content/Summary	Remark
00	2019/05/06	--	First issued.	

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	3/26
Document No.		Issue date	2019/05/06	Revision	00

CONTENTS

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	4/26
Document No.		Issue date	2019/05/06	Revision	00

1.0 General Descriptions

1.1 Introduction

The PV94500QXT40A 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 9.45 inch diagonally measured active display area with 1,540x1,540 resolution (1,540 horizontal by 1,540vertical pixels array).

1.2 Features

- ■ Supported 1,540x1,540 Resolution
- ■ LVDS Interface
- ■ Wide View Angle
- ■ Compatible with RoHS Standard

1.3 Product Summary

Items		Specifications	Unit
Screen Diagonal (Diameter)		9.45	inch
Active Area (Diameter)		240	mm
Number of Pixels (H x V)		1,540 x 1,540	-
Pixel Pitch (H x V)		0.15585 x 0.15585	mm
Pixel Arrangement		R.G.B. Vertical Stripe	-
Display Mode		Normally Black	-
White Luminance		(1,000) (Min.)	cd /m^2
Contrast Ratio		(1,000) (Typ.)	-
Response Time		(18) (Typ.) @25℃	ms
Input Voltage		(3.3) (Typ.)	V
Power Consumption		TBD (Max.)	W
Weight		TBD (Max.)	g
Outline Dimension (H x V x D)	W/O PCB	(258.2) (Typ.) x (258.2) (Typ.) x (6.57) (Typ.)	mm
	With PCB	(258.2) (Typ.) x (258.2) (Typ.) x (9.17) (Typ.)	mm
Electrical Interface (Logic)		LVDS	-
Support Color		16.7 M (8bit)	-
NTSC		(70) (Min.)	%
Surface Treatment		Anti-glare,3H	-

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	5/26
Document No.		Issue date	2019/05/06	Revision	00

1.4 Functional Block Diagram

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

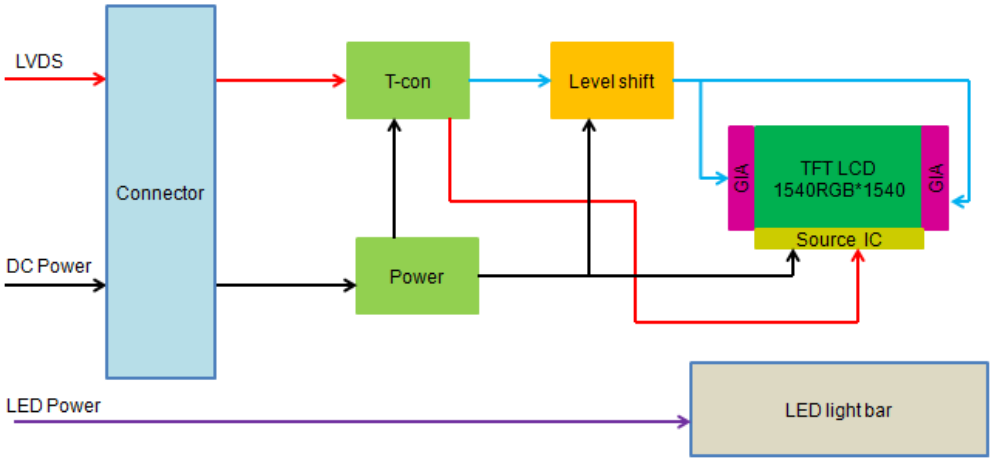


Figure 1 Block Diagram

1.5 Pixel Mapping

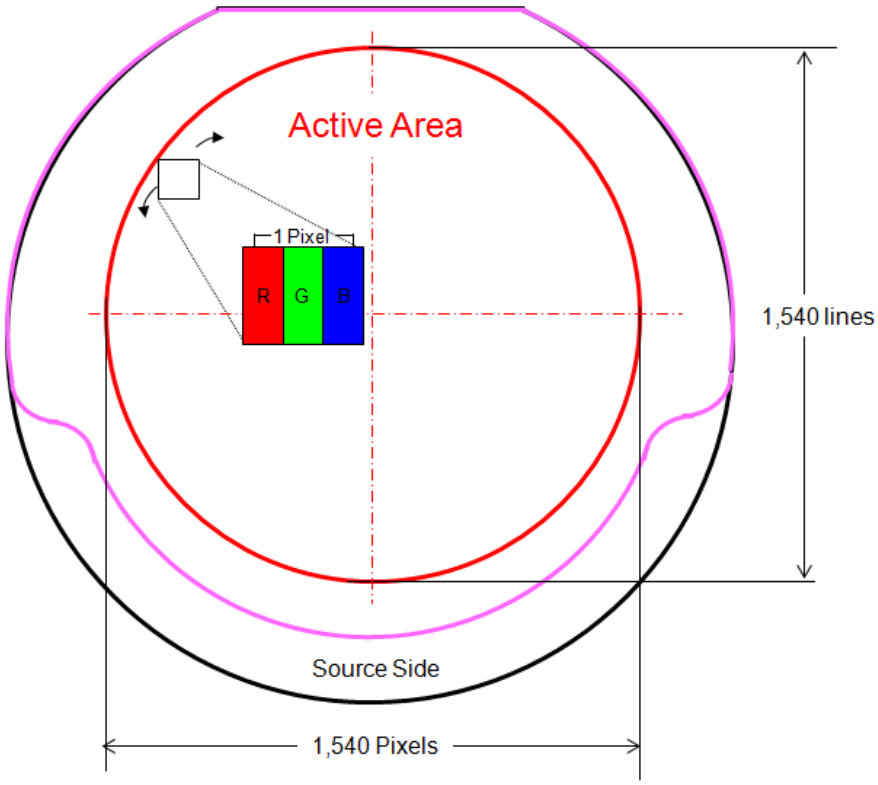


Figure2 Pixel Mapping

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	6/26
Document No.		Issue date	2019/05/06	Revision	00

2.0 Absolute Maximum Ratings

Table 1 Electrical & Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	V_{DD}	(-0.3)	(3.6)	V	(1),(2),(3),(4)
Logic Input Signal Voltage	V_{Signal}	(0)	(2.4)	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.

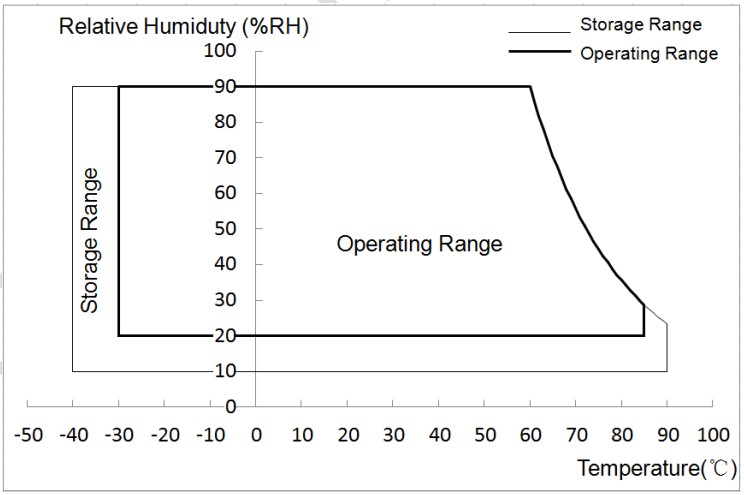


Figure 3 Absolute Ratings of Environment of the LCD Module

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	7/26
Document No.		Issue date	2019/05/06	Revision	00

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)	(1,000)	-	-	(1),(2),(4),(8) θx=θy=0°
Response Time	Rising + Falling	25℃	-	(18)	(25)	ms	(1),(2),(5),(8) θx=θy=0°
		-30℃	-	(300)	(350)		
Color Chromaticity (CIE1931)	Red x		Typ. -(0.025)	(0.646)	Typ. +(0.025)	-	(1),(2),(3),(8) θx=θy=0°
	Red y			(0.346)		-	
	Green x			(0.322)		-	
	Green y			(0.631)		-	
	Blue x			(0.148)		-	
	Blue y			(0.070)		-	
	White x			(0.315)		-	
	White y			(0.341)		-	
NTSC	-		(70)	TBD	-	%	(1),(2),(3),(8) θx=θy=0°
White Luminance	Center Point		(1,000)	TBD	-	cd/m^2	(1),(2),(6),(8) θx=θy=0°
Luminance Uniformity	9 Points	White	(80)	-	-	%	(1),(2),(7),(8) θx=θy=0°
		Black	(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.

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	8/26
Document No.		Issue date	2019/05/06	Revision	00

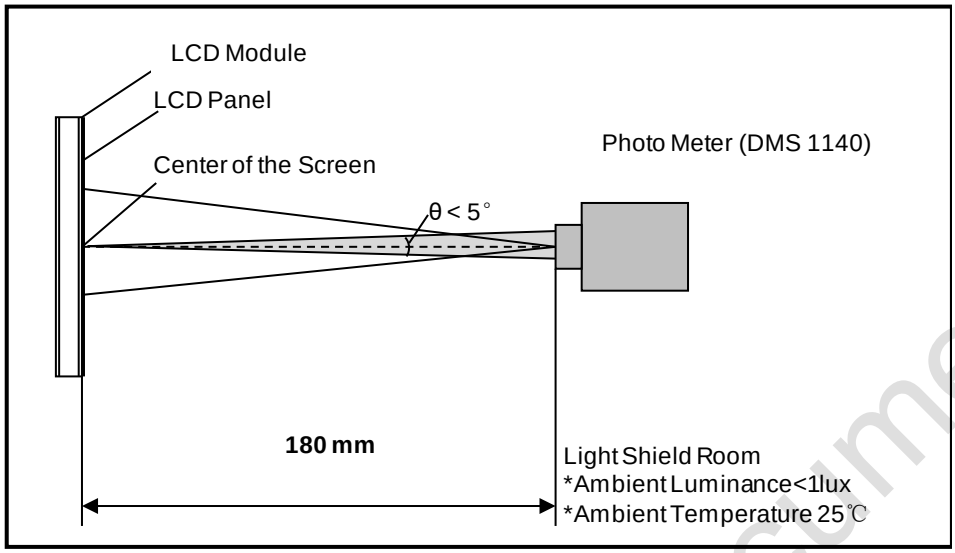


Figure 4 Measurement Setup

Note (2) The LED input parameter setting as:

I_{LED}: 80mAx4=320mA

Note (3) Definition of Viewing Angle

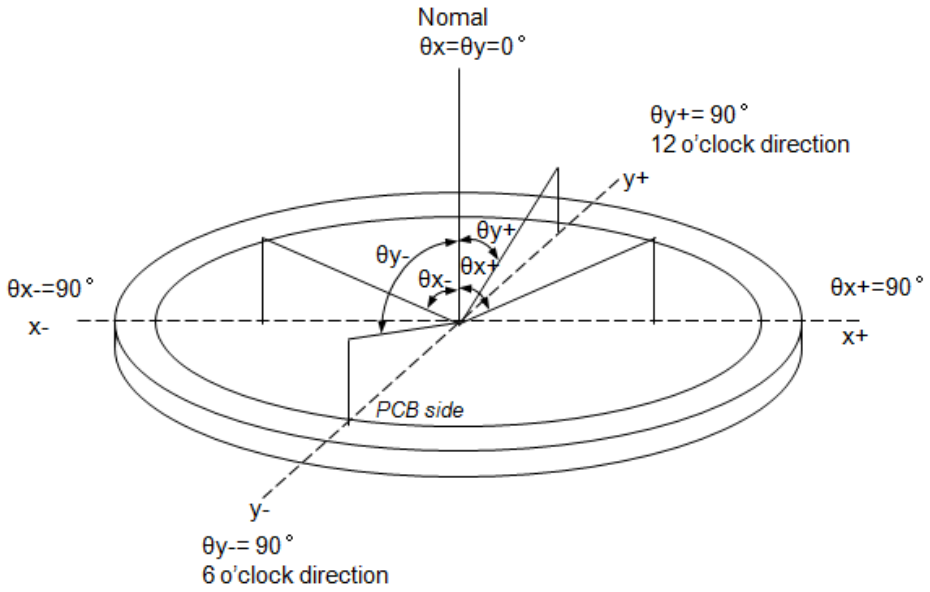


Figure 5 Definition of Viewing Angle

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

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	9/26
Document No.		Issue date	2019/05/06	Revision	00

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

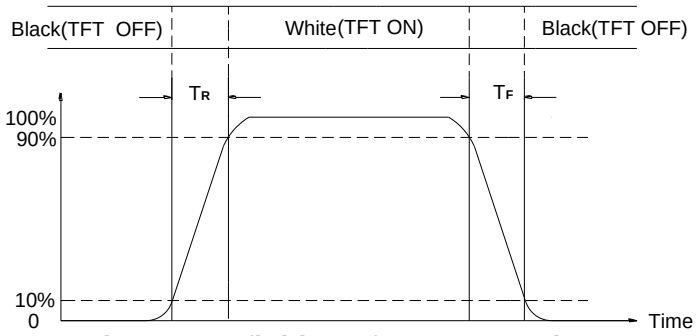


Figure 6 Definition of Response Time

Note (6) Definition of Luminance of White
Measure the luminance of White pattern (Ref.: Active Area)
Display Luminance=L1（center point）

Note (7) Definition of Luminance Uniformity (Ref.: Active Area)
Measure the luminance of White pattern at 9 points.
Luminance Uniformity(White)= Min.(L1, L2, ... L9) / Max.(L1, L2, ... L9)
Measure the luminance of Black pattern at 9 points.
Luminance Uniformity(Black)= Min.(L1, L2, ... L9) / Max.(L1, L2, ... L9)

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

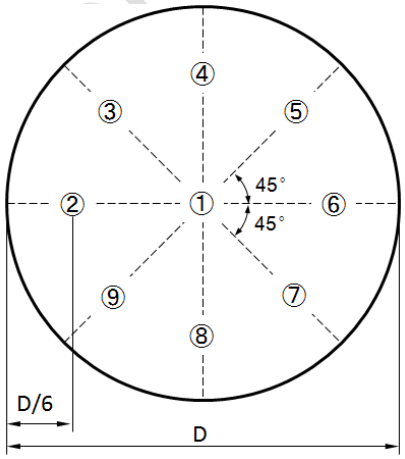


Figure 7 Measurement Locations of 9 Points

Note (8) All optical data are based on IVO 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	Starconn/300E40-0000RA-G3

Table 4 Signal Connector Pin Assignment

Pin No.	Symbol	Description	Remarks
1	GND	Ground	-
2	ELV0N	Even LVDS Data Input 0-	-
3	ELV0P	Even LVDS Data Input 0+	-
4	GND	Ground	-
5	ELV1N	Even LVDS Data Input 1-	-
6	ELV1P	Even LVDS Data Input 1+	-
7	GND	Ground	-
8	ELV2N	Even LVDS Data Input 2-	-
9	ELV2P	Even LVDS Data Input 2+	-
10	GND	Ground	-
11	ELVCLKN	Even LVDS Clock Input -	-
12	ELVCLKP	Even LVDS Clock Input +	-
13	GND	Ground	-
14	ELV3N	Even LVDS Data Input 3-	-
15	ELV3P	Even LVDS Data Input 3+	-
16	GND	Ground	-
17	OLV0N	Odd LVDS Data Input 0-	-
18	OLV0P	Odd LVDS Data Input 0+	-
19	GND	Ground	-
20	OLV1N	Odd LVDS Data Input 1-	-
21	OLV1P	Odd LVDS Data Input 1+	-
22	GND	Ground	-
23	OLV2N	Odd LVDS Data Input 2-	-
24	OLV2P	Odd LVDS Data Input 2+	-
25	GND	Ground	-
26	OLVCLKN	Odd LVDS Clock Input -	-
27	OLVCLKP	Odd LVDS Clock Input +	-
28	GND	Ground	-
29	OLV3N	Odd LVDS Data Input 3-	-
30	OLV3P	Odd LVDS Data Input 3+	-
31	GND	Ground	-

32	I2C_SCL	Control Register Input Clock	-
33	I2C_SDA	Control Register Input Data	-
34	BIST	Aging Pattern Selection	LCD Panel Self Test Enable,when it is not used,connecting to GND is recommended, don't floating
35	GND	Ground	-
36	VDD	3.3+/-0.3V	-
37	VDD	3.3+/-0.3V	-
38	VDD	3.3+/-0.3V	-
39	VDD	3.3+/-0.3V	-
40	GND	Ground	-

Table 5 LED Connector Name / Designation

Item	Description
Manufacturer / Type	TBD

Table 6 LED Connector Pin Assignment

Pin No.	Symbol	Remarks
1	NTC+	-
2	NTC-	-
3	NC	-
4	LED-A	-
5	LED-A	-
6	NC	-
7	LED-K1	-
8	LED-K2	-
9	LED-K3	-
10	LED-K4	-

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 7 LVDS Receiver Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	Vth	-	-	+100	mV	V_{IC}=+1.2V
Differential Input Low Threshold	Vtl	-100	-	-	mV	V_{IC}=+1.2V
Magnitude Differential Input Voltage	$\|V_{ID}\|$	100	-	600	mV	-
Common Mode Voltage	V_{IC}	0.7	-	1.6	V	-
Common Mode Voltage Offset	ΔV_{IC}	-	TBD	-	mV	V_{CM}=+1.2V

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

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

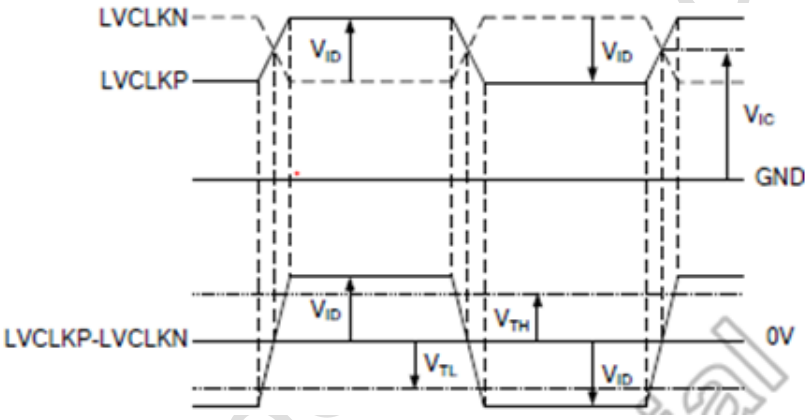


Figure 8 Voltage Definitions

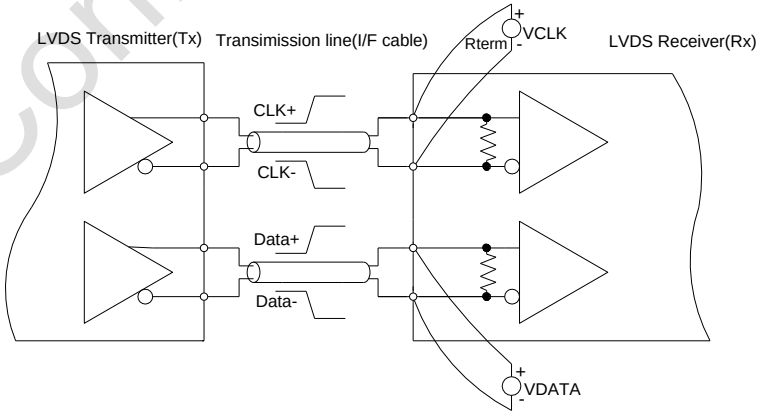


Figure 9 Measurement System

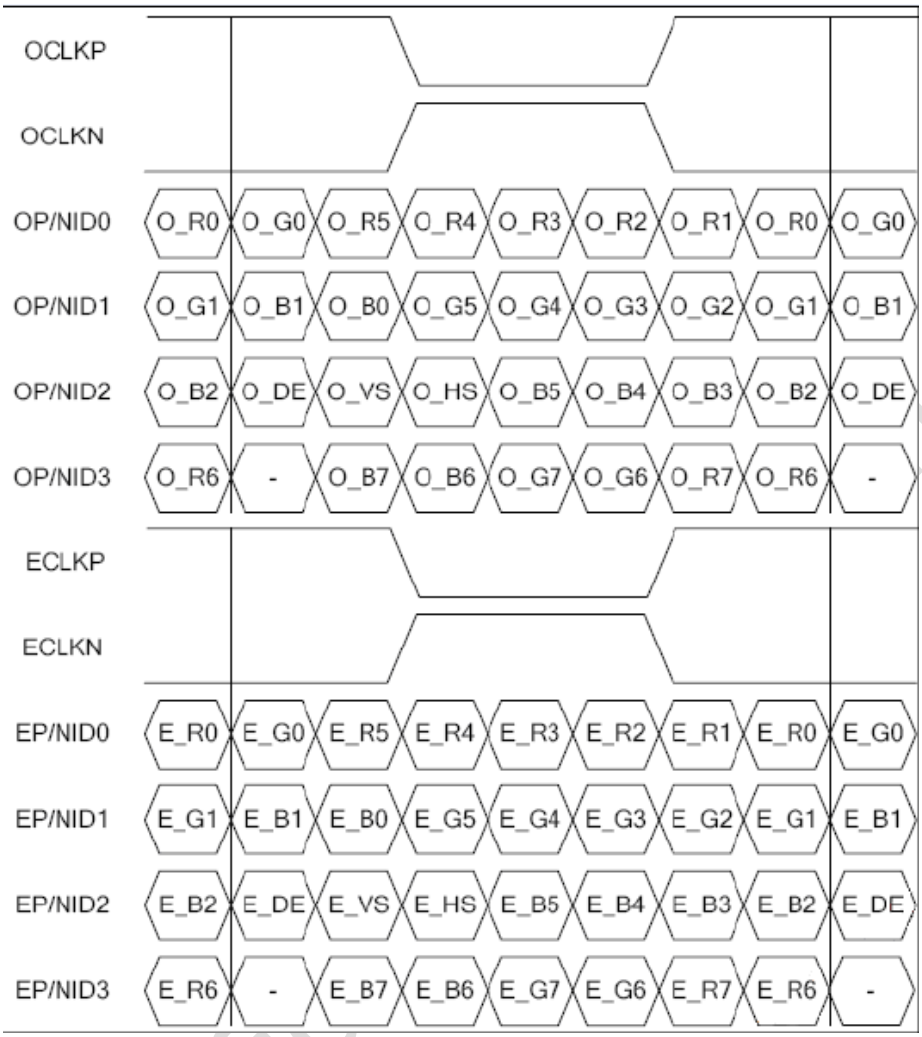


Figure 10 Data Mapping

4.2.2 LVDS Receiver Internal Circuit

Figure 11 shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link.

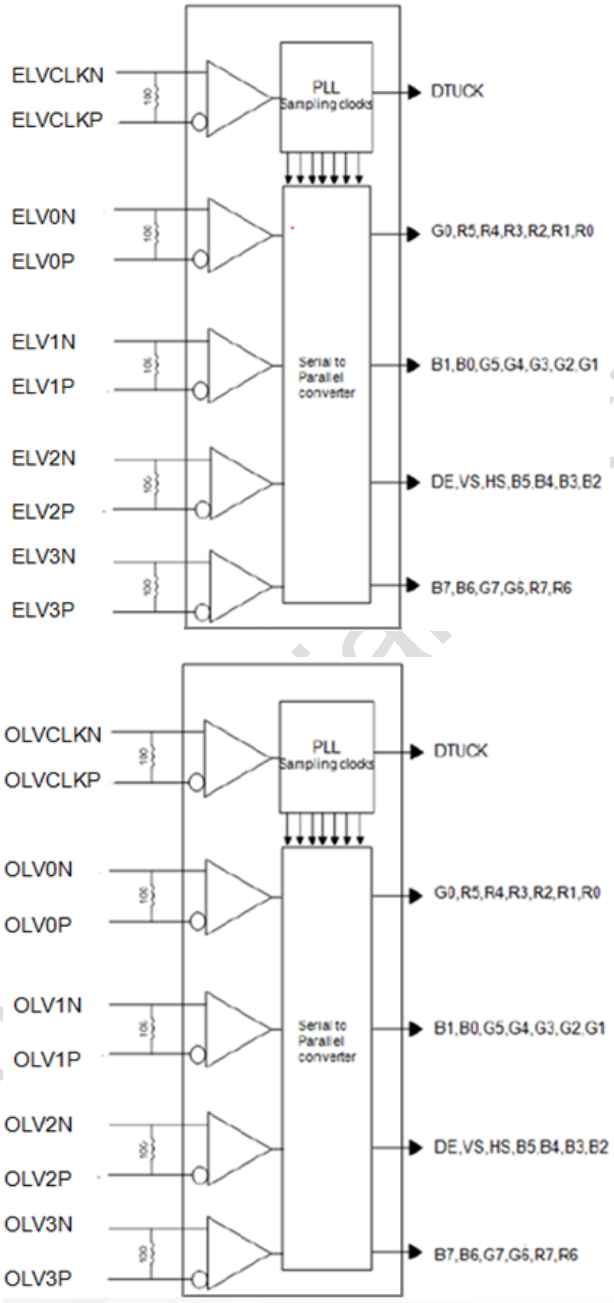


Figure 11 LVDS Receiver Internal Circuit

4.3 Interface Timings

Table 8 Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
LVDS Clock Frequency	Fclk	(159.12)	(164.95)	(176.64)	MHz
H Total Time	HT	(1,700)	(1,740)	(1,840)	Clocks
H Active Time	HA		1,540		Clocks
V Total Time	VT	(1,560)	(1,580)	(1,600)	Lines
V Active Time	VA		1,540		Lines
Frame Rate	FV	-	60	-	Hz

Note1：HT * VT *Frame Frequency ≤ 176.64MHz

Note2: All reliabilities are specified for timing specification based on refresh rate of 60Hz.

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	16/26
Document No.		Issue date	2019/05/06	Revision	00

4.4 Input Power Specifications

Input power specifications are as follows.

Table 9 Input Power Specifications

Parameter		Symbol	Min.	Typ.	Max.	Unit	Note
System Power Supply							
LCD Drive Voltage (Logic)		V_{DD}	3.0	3.3	3.6	V	(1),(2)
VDD Current	Black Pattern	I_{DD}	-	-	(0.1371)	A	(1),(3)
VDD Power Consumption	Black Pattern	P_{DD}	-	-	(0.4524)	W	
LCD Self Test (BIST)	High level voltage	V_{BIST}	TBD	-	TBD	V	(1)
	Low level voltage		TBD	-	TBD	V	
Rush Current		I_{Rush}	-	-	(1.5)	A	(1),(4)
Allowable Logic/LCD Drive Ripple Voltage		V_{VDD-RP}	-	-	(200)	mV	(1)
LED Power Supply							
LED Input Voltage		V_{LED}	TBD	TBD	TBD	V	(1),(2)
LED Power Consumption		P_{LED}	-	-	TBD	W	(1),(5)
LED Forward Voltage		V_F	-	-	(3.4)	V	(1),(2)
LED Forward Current		I_F	-	(80)	-	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_{DD} current and power consumption are measured under the V_{DD} = 3.3 V, FV= 60 Hz condition and Black pattern.

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

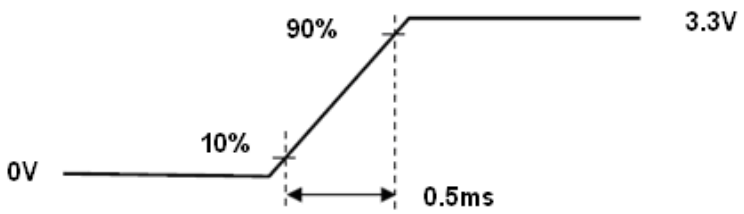


Figure 12 V_{DD} Rising Time

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	17/26
Document No.		Issue date	2019/05/06	Revision	00

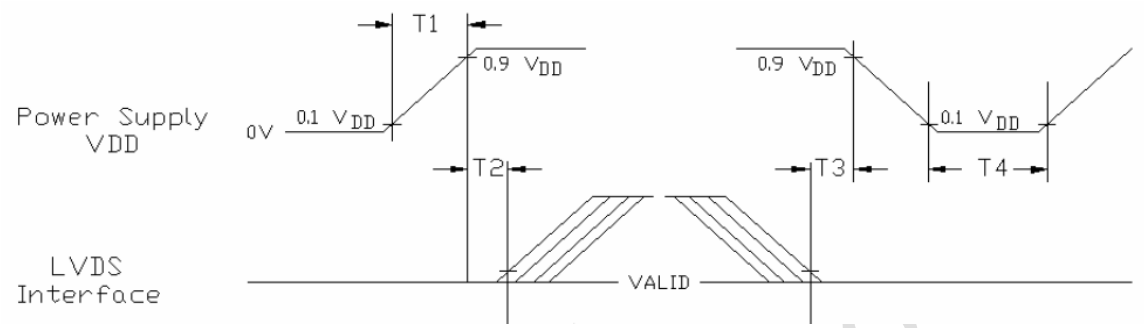
Note (5) The power consumption of LED Driver are under the V_{LED} = TBD, Dimming of Max luminance.

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.

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 VDD voltage is off.

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



0.5 ms ≤ T1 ≤ 10 ms : 0 ≤ T2 ≤ 50 ms : 0 ≤ T3 ≤ 50 ms : 500 ms ≤ T4 .

Figure 13 Power Sequence

5.0 Mechanical Characteristics

5.1 Outline Drawing

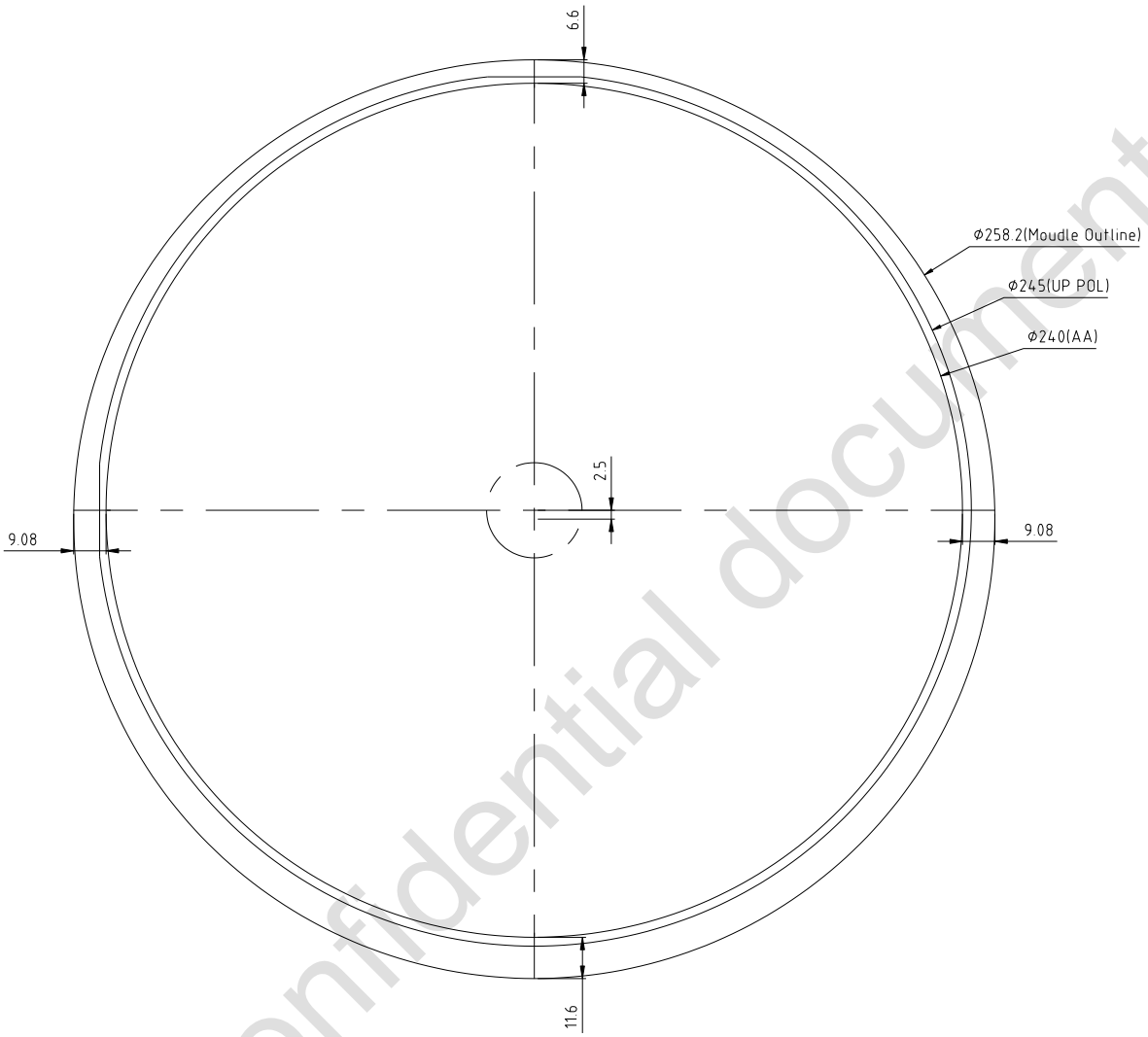


Figure 14 Reference Outline Drawing (Front Side)

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	20/26
Document No.		Issue date	2019/05/06	Revision	00

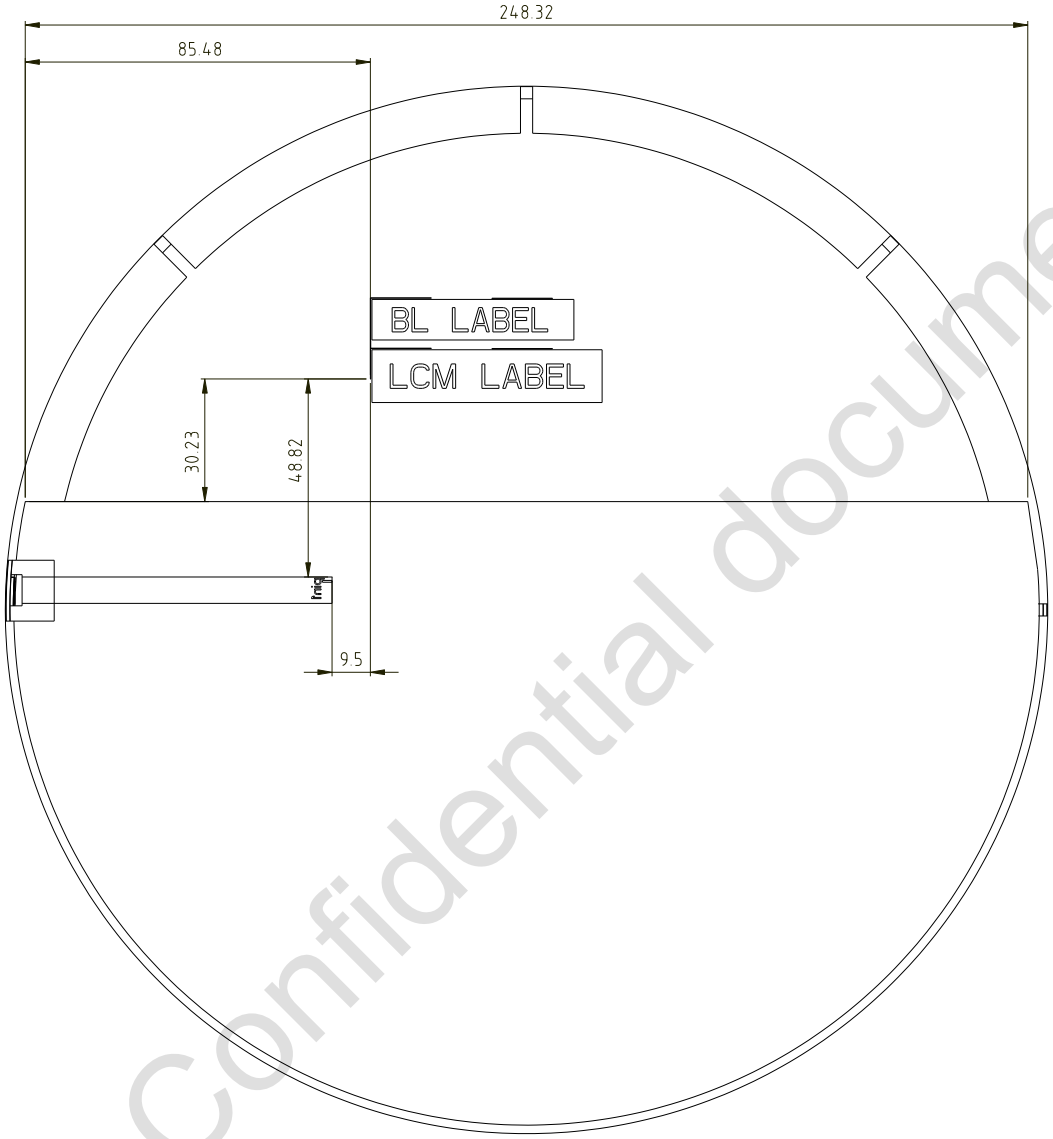


Figure 15 Reference Outline Drawing (Back Side)

5.2 Dimension Specifications

Table 10 Module Dimension Specifications

Item		Min.	Typ.	Max.	Unit
Width		TBD	(258.2)	TBD	mm
Height		TBD	(258.2)	TBD	mm
Thickness	Without PCBA	-	(6.57)	TBD	mm
	With PCBA	-	(9.17)	TBD	mm
Weight		-	-	TBD	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)
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	

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 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.

7.0 Package Specification

TBD

Figure 16 Packing Method

8.0 Lot Mark

TBD

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	25/26
Document No.		Issue date	2019/05/06	Revision	00

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) 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.

(6) A transparent protective film needs to be attached to the surface of the module.

(7) 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.

(8) Clean the polarizer gently with absorbent cotton or soft cloth when it is dirty.

(9) Wipe off saliva or water droplet as soon as possible. Otherwise, it may cause deformation and fading of color.

Document Title	PV94500QXT40A Tentative Product Specification			Page No.	26/26
Document No.		Issue date	2019/05/06	Revision	00

(10) Desirable cleaners are IPA (Isopropyl Alcohol) or hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(11) Do not disassemble or modify the module. It may damage sensitive parts in the LCD module, and cause scratches or dust remains. Kingtech does not warrant the module, ifyou 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.