IVO **InfoVision Optoelectronics (Kunshan) Co.,LTD.**

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Product Specification

To:

Product Name: M090AWA5 R0

Document Issue Date: 2019/11/25

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

Note : 1. Please contact InfoVision Company before designing your product based on this product.

2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by IVO for any intellectual property claims or other problems that may result from application based on the module described herein.

FQ-7-30-0-009-03D

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00	2019/11/25	--	First issued.	

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1.0 General Descriptions

1.1 Introduction

The M090AWA5 R0 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 9.0 inch diagonally measured active display area with HD resolution 1,280 horizontal by 720 vertical pixels array.

1.2 Features

■ Supported HD Resolution

■ LVDS Interface

■ Wide View Angle

■ Compatible with RoHS Standard

1.3 Product Summary

Items		Specifications	Unit
Screen Diagonal		9.0	inch
Active Area (H x V)		198.72x 111.78	mm
Number of Pixels (H x V)		1,280 x 720	-
Pixel Pitch (H x V)		0.15525 x 0.15525	mm
Pixel Arrangement		R.G.B. Vertical Stripe	-
Display Mode		Normally Black	-
White Luminance		880 (Typ.) @ Center & 25℃	cd /m^2
Contrast Ratio		1,000 (Typ.) @ Center & 25℃	-
Response Time		30 (Typ.) @ 25℃	ms
Input Voltage		3.3(Typ.)	V
Power Consumption		7.275 (Max.) @ White pattern ,FV=60Hz	W
Weight		335 (Max.)	g
Outline Dimension (H x V x D)	Without PCB	212.20 (Typ.) x 127.50(Typ.) x 7.90 (Max.)	mm
	With PCB	212.20 (Typ.) x 127.50(Typ.) x 10.76 (Max.)	mm
Electrical Interface (Logic)		LVDS	-
Support Color		16.7 M	-
NTSC		70 (Typ.)	%
Surface Treatment		AG,3H	-
Surface reflectance (SCI)		6.0% (Max.)	-

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1.4 Functional Block Diagram

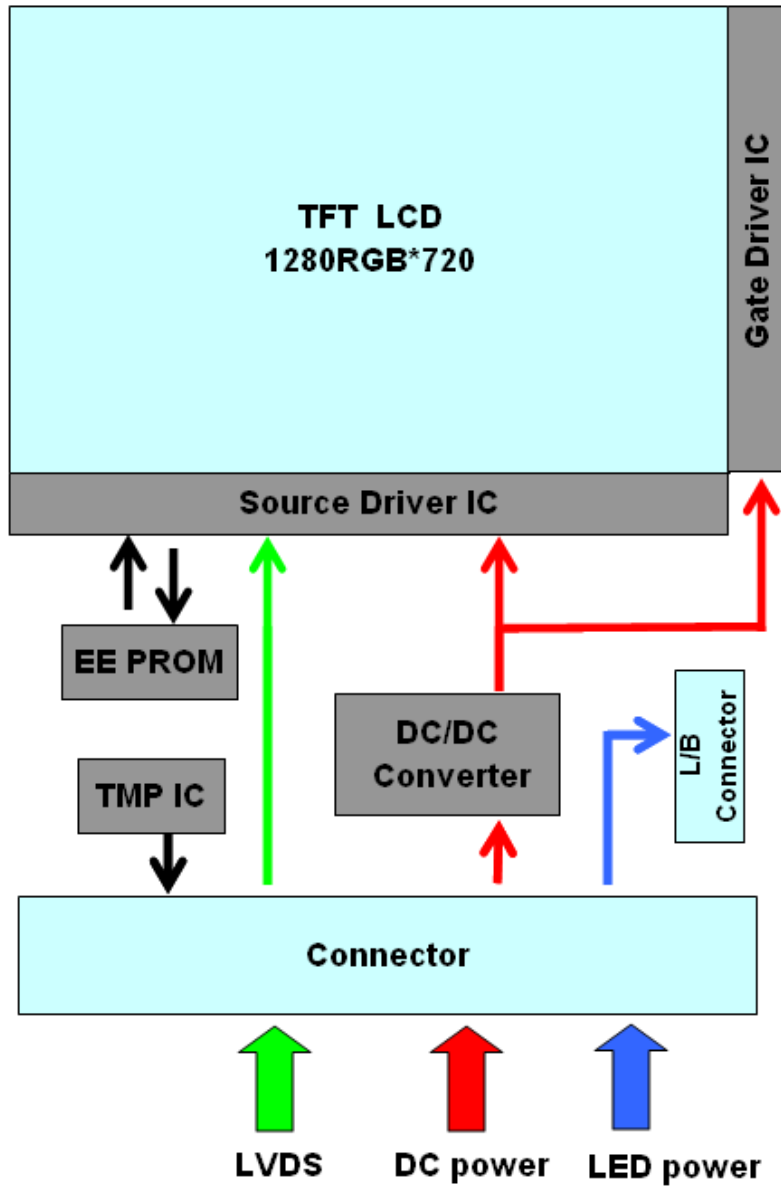Figure 1 shows the functional block diagram of the LCD module.

Figure 1   Block Diagram

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1.5 Pixel Mapping

Figure 2   Pixel Mapping

IVO **InfoVision Optoelectronics (Kunshan) Co.,LTD.**
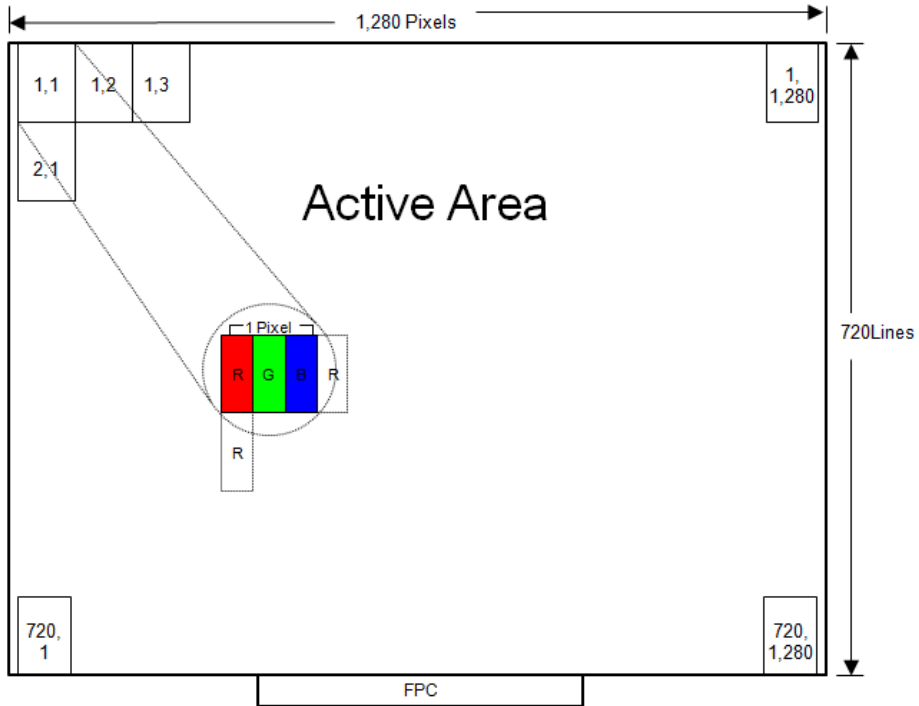
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2.0   Absolute Maximum Ratings

Table 1   Electrical & Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	V_{DD}	-0.3	4.0	V	(1),(2),
Storage Temperature	T_a	-40	90	℃	(3),(4)
Operating Temperature	T_{gs}	-30	85	℃	(1),(2), (3),(4),(5)

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.
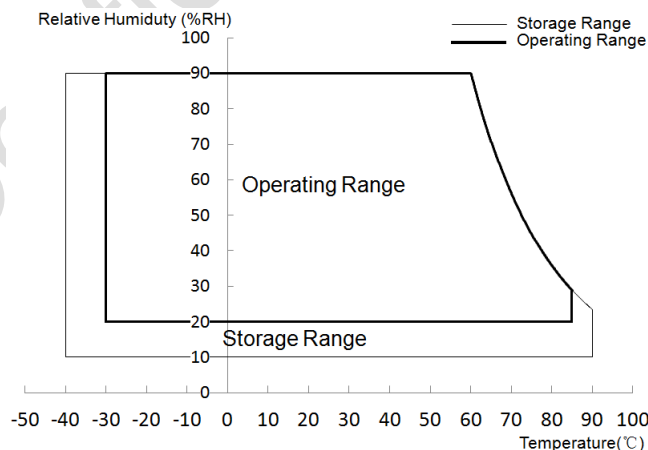

Figure 3   Absolute Ratings of Environment of the LCD Module

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Note (5) The graph below is reference data as LCD module only
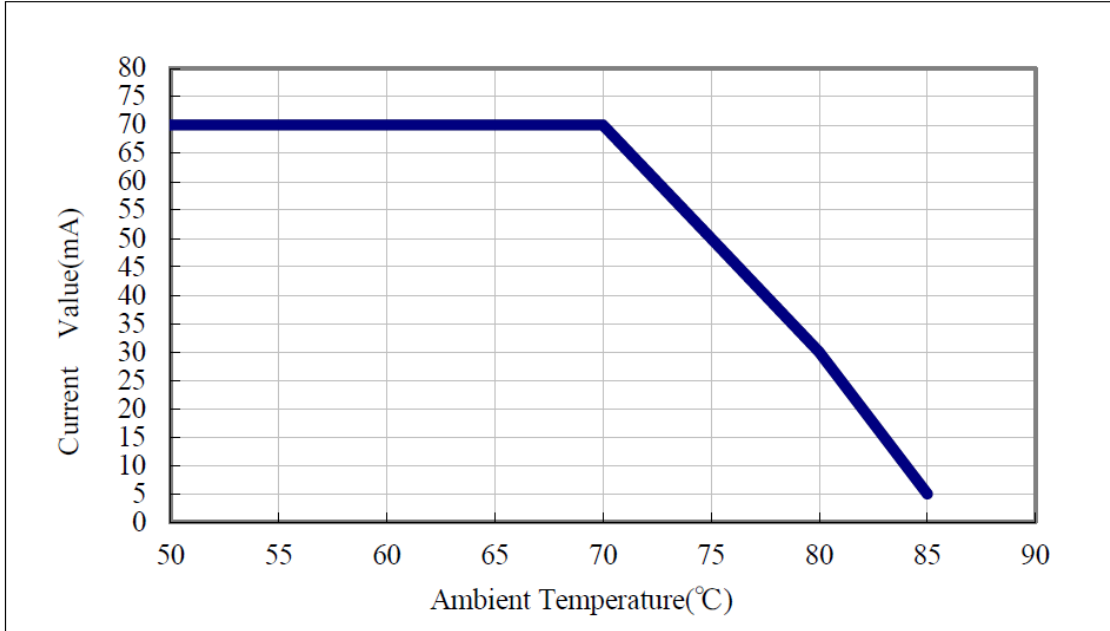
Figure 4   Current of LED vary with environmental temperature

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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+	75	80	-	degree	(1),(2),(3), (4)(8)
		θ x-	75	80	-		
	Vertical	θ y+	75	80	-		
		θ y-	75	80	-		
Contrast Ratio	Ta=25℃	Center	700	1,000	-		(1),(2), (4),(8)
		LR 45°,UD 30°	200	-	-		
	Ta=-30℃ ~Tp= 85℃	LR 45°,UD 30°	100	-	-		
Response Time	Rising + Falling	Ta=25℃	-	30	40	ms	(1),(2), (5),(8) θx=θy=0°
		Ta=0℃	-	65	95		
		Ta=-20℃	-	150	200		
		Ta=-30℃	-	300	450		
Color Chromaticity (CIE1931)	Red x			0.638		-	(1),(2), (3),(8) θx=θy=0°
	Red y			0.344		-	
	Green x		Typ. -0.04	0.317	Typ. +0.04	-	
	Green y			0.625		-	
	Blue x			0.149		-	
	Blue y			0.078		-	
	White x			0.310		-	
	White y			0.330		-	
NTSC	-		65	70	-	%	(1),(2), (3),(8) θx=θy=0°
White Luminance	Ta=25℃	Center	700	880	-		(1),(2), (6),(8)
	Ta=-40℃ ~Tp=70℃	LR 45°,UD 30°	190	240	-		
Luminance Uniformity	9 Points		70	-	-	%	(1),(2), (7),(8) θx=θy=0°
Reflectance	SCI		-	5.5	6.0	%	(9)

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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.
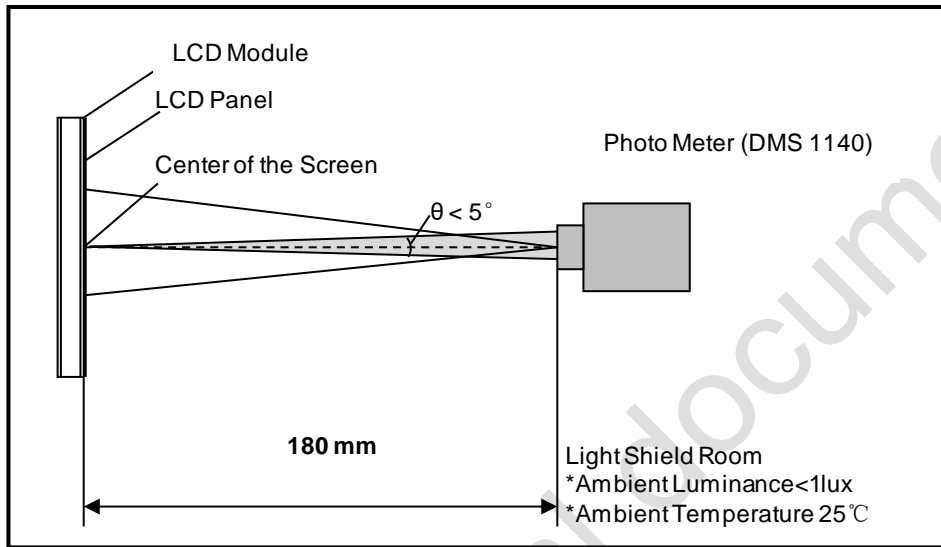

Figure 5   Measurement Setup

Note (2) The LED input parameter setting as:

I_{LED}: 280mA

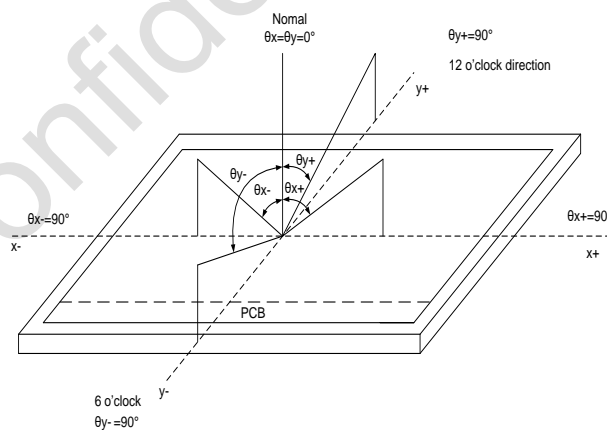Note (3) Definition of Viewing Angle

Figure 6   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)

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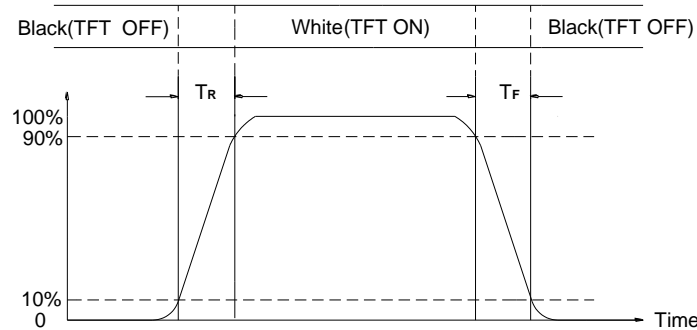| Document Title	M090AWA5 R0 Product Specification		Page No.	11/28
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Figure 7   Definition of Response Time

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= Min.(L1, L2, ... L9) / Max.(L1, L2, ... L9)
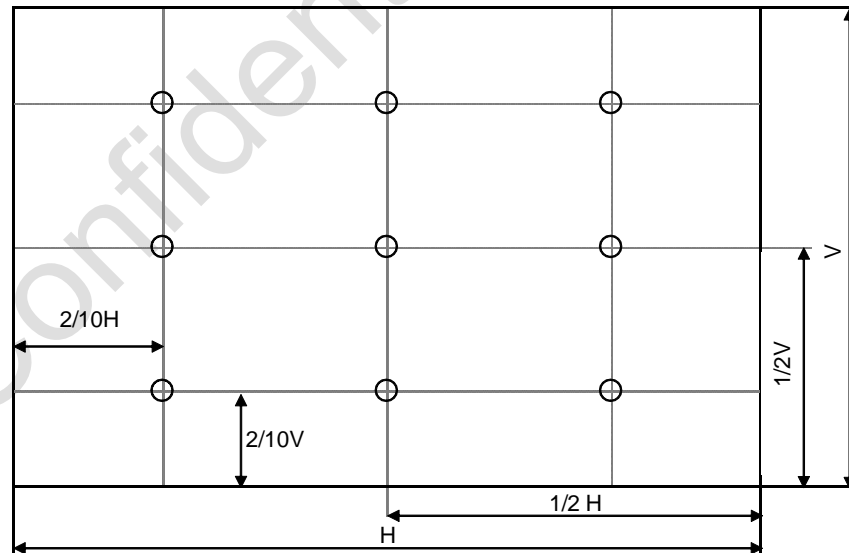
H—Active Area Width, V—Active Area Height, L—Luminance

Figure 8   Measurement Locations of 9 Points

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

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4.0 Electrical Characteristics

4.1 Interface Connector

Table 3   Signal Connector Type

Item	Description
Manufacturer / Type	MOLEX 505110-4091

Table 4   Signal Connector Pin Assignment

Pin No.	Symbol	Description	Remarks
1	GND	Ground	-
2	GND	Ground	-
3	PIND3	LVDS differential data input	-
4	NIND3	LVDS differential data input	-
5	GND	Ground	-
6	CLKP	LVDS differential Clock input	-
7	CLKN	LVDS differential Clock input	-
8	GND	Ground	-
9	PIND2	LVDS differential data input	-
10	NIND2	LVDS differential data input	-
11	GND	Ground	-
12	PIND1	LVDS differential data input	-
13	NIND1	LVDS differential data input	-
14	GND	Ground	-
15	PIND0	LVDS differential data input	-
16	NIND0	LVDS differential data input	-
17	GND	Ground	-
18	SDA	Digital temperature sensor serial data	-
19	SCL	Digital temperature sensor serial clock	-
20	NC	NC	-
21	NC	NC	-
22	GND	Ground	-
23	VDDA	Power supply for 3.3V	-
24	VDDA	Power supply for 3.3V	-
25	VDDA	Power supply for 3.3V	-
26	VDDA	Power supply for 3.3V	-
27	VDDA	Power supply for 3.3V	-

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28	NC	NC	-
29	GND	Ground	-
30	GND	Ground	-
31	GND	Ground	-
32	NC	NC	-
33	CATHODE1	Power supply for LED circuit(Cathode1)	-
34	CATHODE2	Power supply for LED circuit(Cathode2)	-
35	CATHODE3	Power supply for LED circuit(Cathode3)	-
36	CATHODE4	Power supply for LED circuit(Cathode4)	-
37	NC	NC	-
38	ANODE	Power supply for LED circuit (Anode)	-
39	ANODE	Power supply for LED circuit (Anode)	-
40	ANODE	Power supply for LED circuit (Anode)	-

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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	Vth	-	-	+150	mV	V_{CM}=+1.2V
Differential Input Low Threshold	Vtl	-150	-	-	mV	V_{CM}=+1.2V
Magnitude Differential Input	$|V_{ID}|$	150	-	600	mV	-
Strobe Width	TSW	0.4	-	-	UI	FLVCK≤65
Common Mode Voltage	V_{CM}	1.0	1.2	1.7-|VID|/2	V	-
Common Mode Voltage Offset	ΔV_{CM}	-	-	50	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.
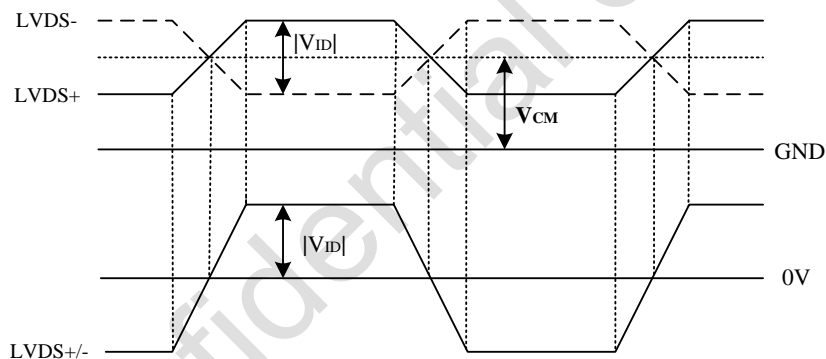

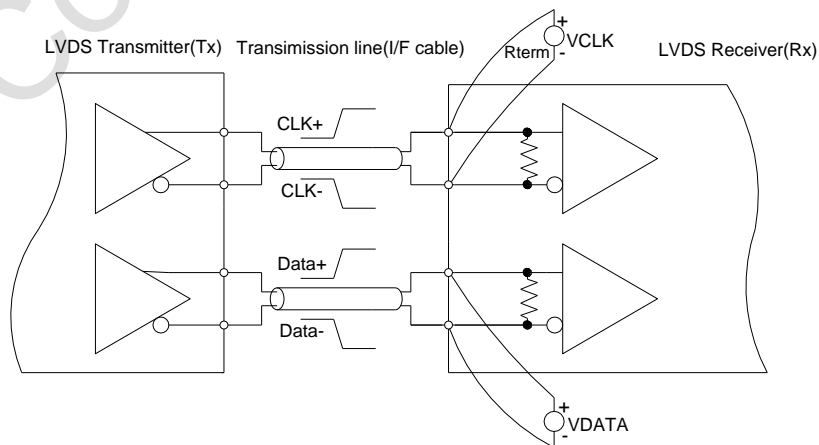**Figure 9   Voltage Definitions**

Figure 10   Measurement System

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Figure 11   Data Mapping

IVO **InfoVision Optoelectronics (Kunshan) Co.,LTD.**
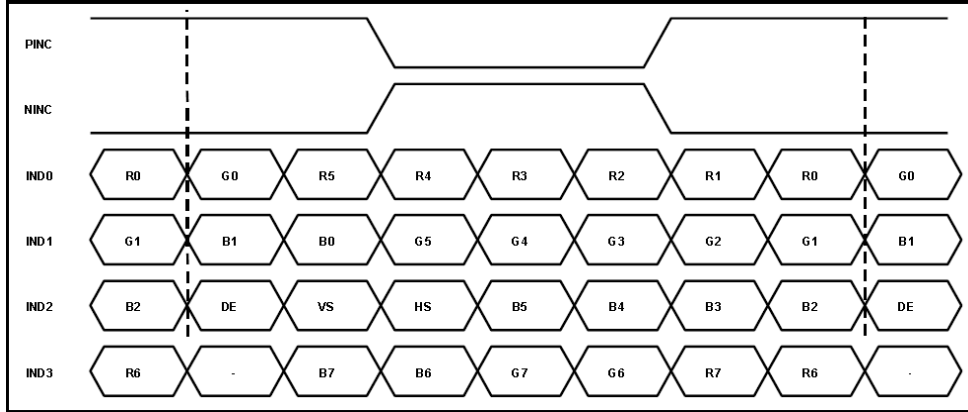
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4.2.2 LVDS Receiver Internal Circuit

Figure 12 shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link.
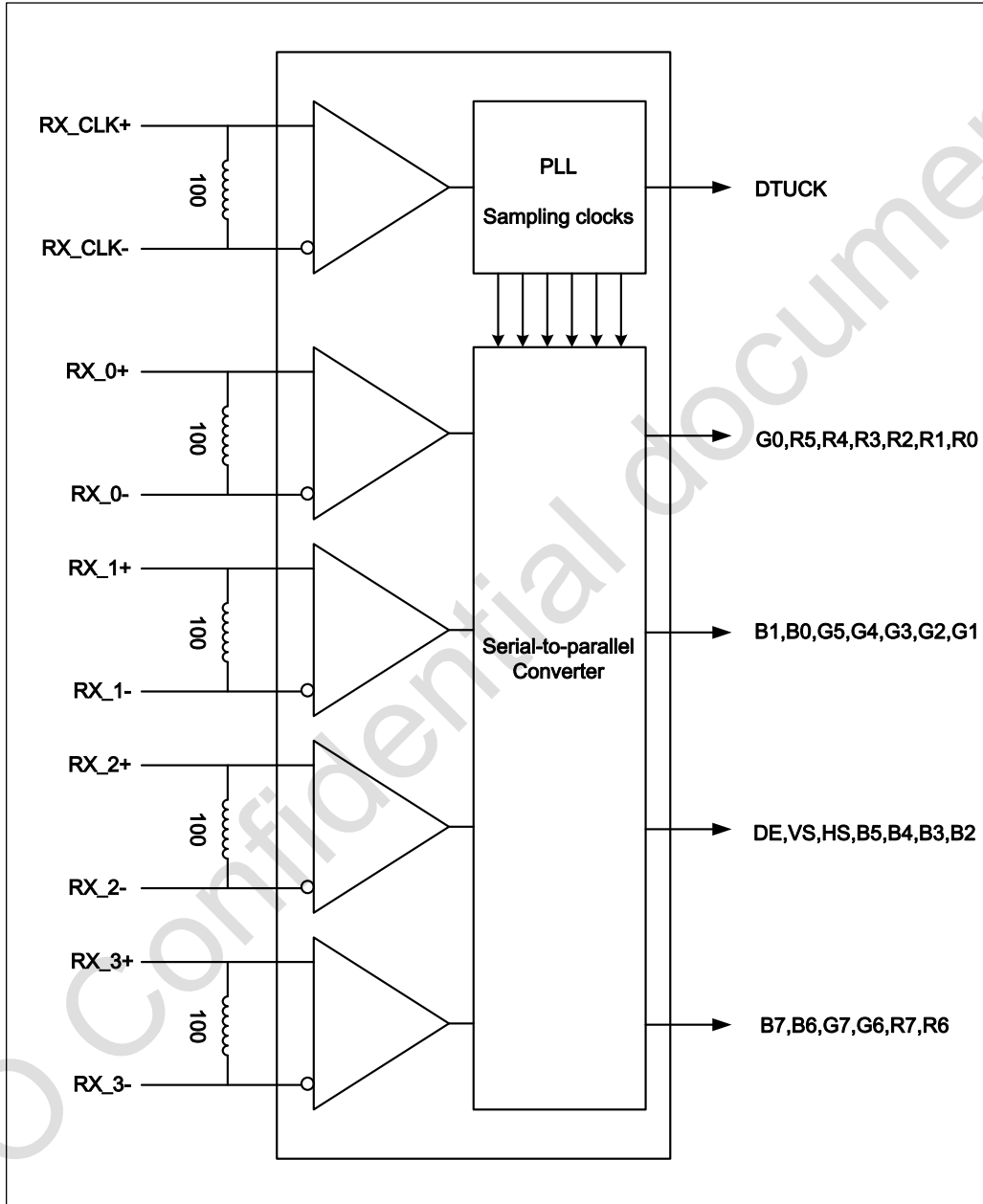

Figure 12   Receiver Internal Circuit

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4.3 Interface Timings

Table 6   Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
LVDS Clock Frequency	Fclk	58.4	59	74.9	MHz
H Total Time	HT	1,340	1,354	1,470	Clocks
H Active Time	HA		1,280		Clocks
V Total Time	VT	726	726	849	Lines
V Active Time	VA		720		Lines
Frame Rate	FV	55	60	65	Hz

Note1：HT * VT *Frame Frequency≤74.9 MHz

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

A090AWA5 R0 is secured only for function under lower refresh rate; 60Hz at Normal mode, 55Hz at Power save mode. Don't care flicker level (power save mode)

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4.4 Input Power Specifications

Input power specifications are as follows.

Table 7   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	White Pattern	I_{DD}	-	-	0.245	A	
VDD Power Consumption	White Pattern	P_{DD}	-	-	0.807	W	(1),(4)
LCD Self Test (BIST)	VIH	V_{BIST}	3.0	-	3.6	V	(1)
	VIL		0	-	0.5	V	
Rush Current		I_{Rush}	-	-	1.5	A	(1),(5)
Allowable Logic/LCD Drive Ripple Voltage		V_{VDD-RP}	-	-	200	mV	(1),(3)
LED Power Supply							
LED Input Voltage		V_{LED}	19.6	21	23.1	V	(1),(2)
LED Power Consumption		P_{LED}	-	5.88	6.468	W	(1),(6)
LED Forward Voltage		V_F	2.8	3.0	3.3	V	(1),(2),(6)
LED Forward Current		I_F	-	70	-	mA	
LED Life Time		LT	15,000	-	-	Hours	(1),(5)

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 White 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.

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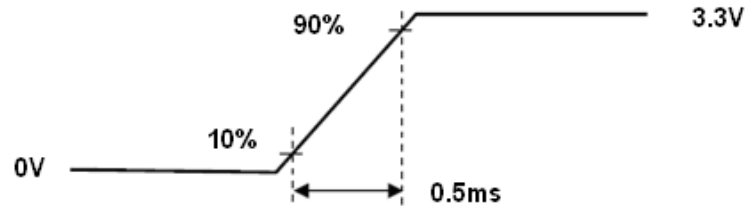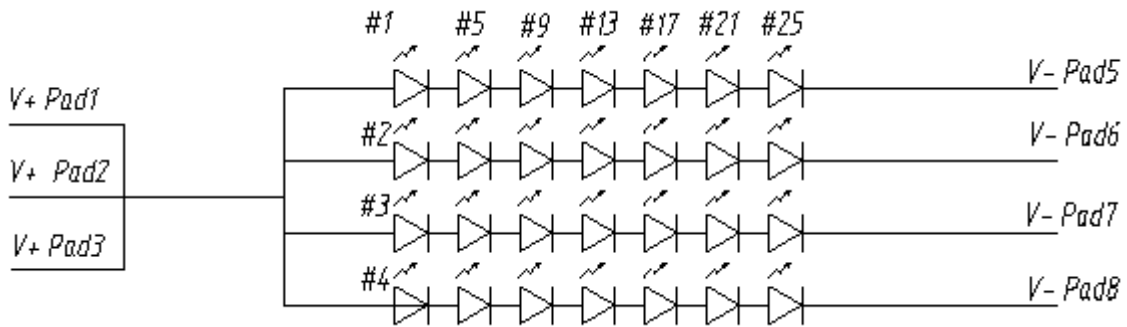| Document Title	M090AWA5 R0 Product Specification		Page No.	19/28
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Figure 13 V_{DD} Rising Time

Note (5) The life time is determined as the sum of the lighting time till the luminance of LCD at the typical LED current reducing to 70% of the minimum value under normal operating condition.

Note (6) Definition of VLED and PLED $V_{LED} = V_F \times 7$, $I_{LED} = I_F \times 4$, $PLED = V_{LED} \times I_{LED}$

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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.
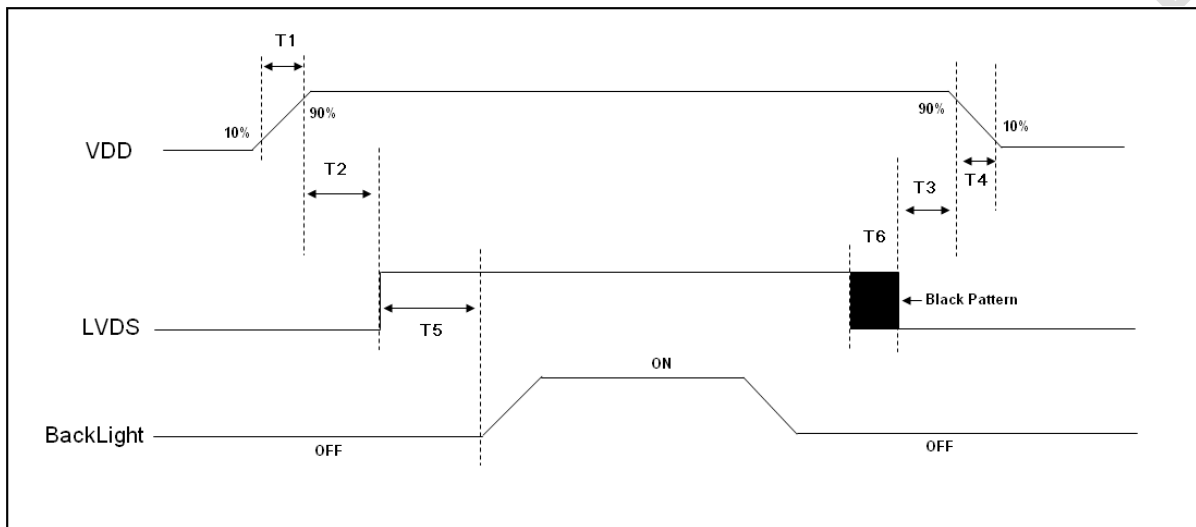
Note 1: When VDDA was less than VTH, re·power (OFF/ON) supply is necessary.

Note 2: Before the power supply is turned off, please make sure to display the black pattern for 2 frames' time

Note 3: Before the power supply is turned on again, please make sure the OFF sequence already done

Figure 14   Power Sequence

Table 8 Power Sequencing Requirements

Parameter	Symbol	Unit	min	typ	max
VDDA Rising Time	T1	ms	0.0002	--	10
VDDA ready to LVDS start	T2	ms	200	--	--
Back light OFF to VIN off	T3	ms	0	--	--
VDDA Falling Time	T4	ms	1	--	100
LVDS ready to Back light ON	T5	ms	16.7	--	--
Black Pattern before Back light OFF	T6	ms	33.3	--	--

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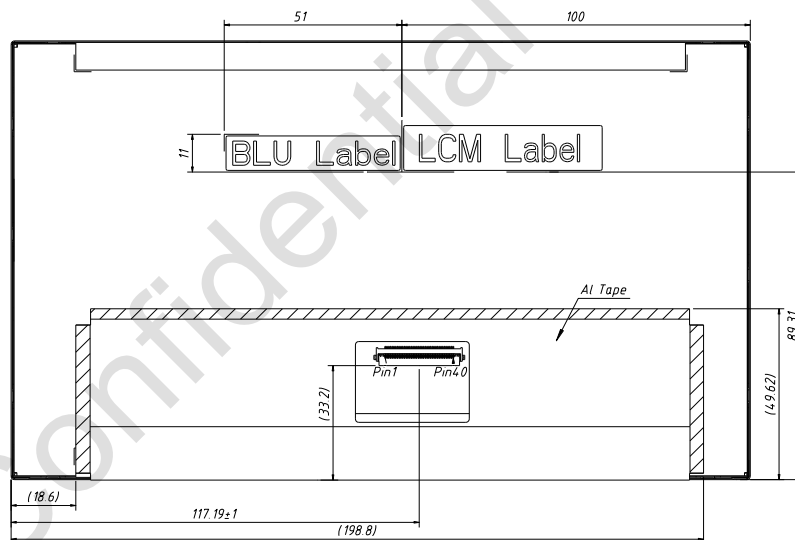| Document Title	M090AWA5 R0 Product Specification		Page No.	21/28
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5.0 Mechanical Characteristics

5.1 Outline Drawing
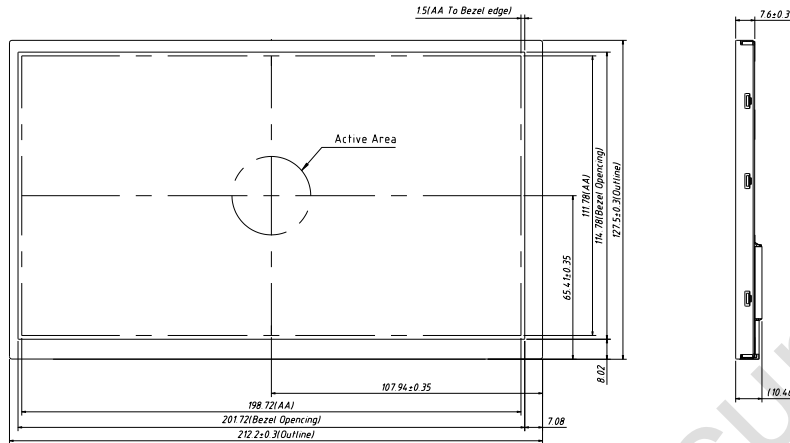
Unit: mm

Figure 15   Reference Outline Drawing (Front Side)

Unit: mm

Figure 16   Reference Outline Drawing (Back Side)

Note: Not marked tolerance is ±0.3mm.

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5.2 Dimension Specifications

Table 9   Module Dimension Specifications

Item		Min.	Typ.	Max.	Unit
Width		211.9	212.20	212.5	mm
Height		127.2	127.50	127.8	mm
Thickness	Without PCBA	-	7.60	7.90	mm
	With PCBA	-	10.46	10.76	mm
Weight		-	-	335	g
BM: │a-b│ & │c-d│		-	-	1.0	mm

Note：Outline dimension measure instrument: Vernier Caliper.

Figure 17   BM Area

IVO InfoVision Optoelectronics (Kunshan) Co.,LTD.
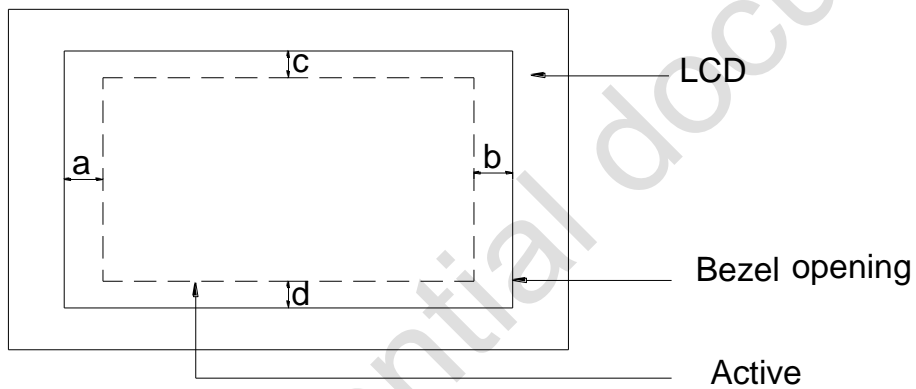
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6.0   Reliability Conditions

Table 10   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		
Shock Non-operating Test		Module	100G , 6ms, ±X/±Y/±Z, 3 times for each direction		(1),(3),(5)
Vibration Non-operating Test		Module	Frequency: 8~33.3Hz，Stroke：1.33mm Frequency：33.3Hz~400Hz，Acceleration:2.9G Cycle:15minutes X,Z 2hours for each direction, 4 hours for Y direction (Total 8 hours)		
ESD Test	Operating	Module	Contact	±8KV, 150pF(330Ohm)	(1),(2),(6)
			Air	±15KV, 150pF(330Ohm)	
	Non-operating		Contact	±10KV, 150pF(330Ohm)	(1),(6)
			Air	±20KV, 150pF(330Ohm)	

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 IVO 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.

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7.0 Package Specification

Figure 18 Packing Method

![IVO] **InfoVision Optoelectronics (Kunshan) Co.,LTD.**
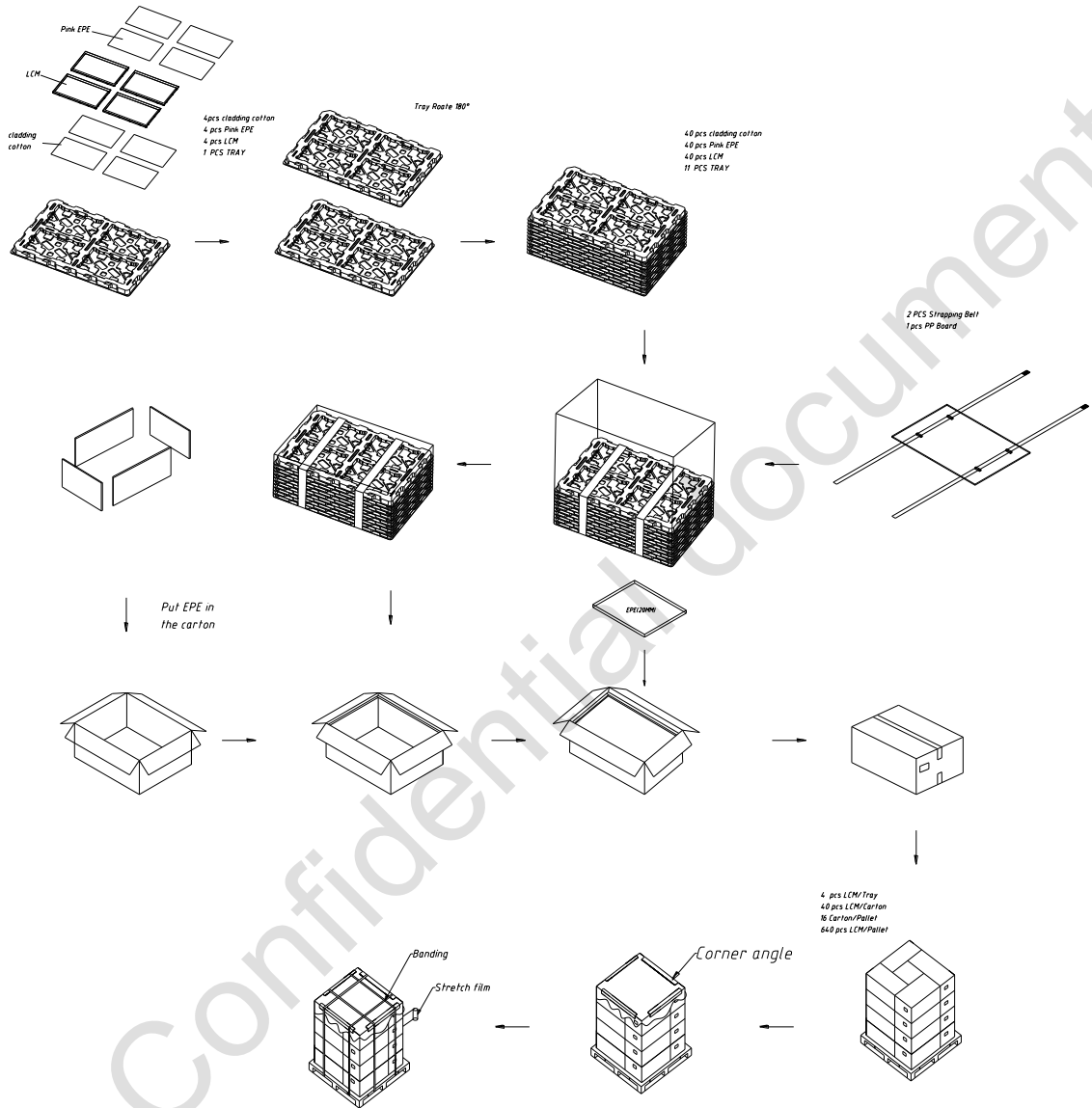
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8.0 Lot Mark

Note: This picture is only an example.

8.1   20 Lot Mark

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20

Code 1,2,4,5,6,7,8,9,10,11,16: IVO internal flow control code.
Code 3: Production Location.
Code 12: Production Year.
Code 13: Production Month.
Code 14,15: Production Day.
Code 17,18,19,20: Serial Number.

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8.2　23 Product Barcode

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23

Code 1,2: Manufacture District.

Code 3,4,5,6,7: IVO internal module name.

Code 8,9,10,13,16: IVO internal flow control code.

Code 11,12: Cell location Suzhou, China defined as "KS".

Code 14 ,15: Module location Kunshan, China defined as "KS"; Yangzhou, China defined as "YZ"; Shenzhen, China defined as "SE"; Zhuhai, China defined as "ZH"; Suzhou, China defined as "SZ".

Code 17,18,19 : Year, Month, Day refer to Note(1), Note(2) and Note(3).

Note (1) Production Year

Year	2006	2007	2008	2009	2010	2011	2012	2013	......	2035
Mark	6	7	8	9	A	B	C	D	......	Z

Note (2) Production Month

Month	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct	Nov.	Dec.
Mark	1	2	3	4	5	6	7	8	9	A	B	C

Note (3) Production Day: 1~V.

Code 20~23 : Serial Number.

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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

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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) 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.

(12) Do not disassemble or modify the module. It may damage sensitive parts in the LCD module, and cause scratches or dust remains. IVO does 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.