

InfoVision Optoelectronics (Kunshan) Co.,LTD.

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1.0 General Descriptions

1.1 Introduction

The V123AWF3 R1 is a Color Active Matrix Liquid Crystal Display with a back light system and cover glass. 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
- In Cell Touch Panel
- 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	1,000(Typ.)	cd /m ²	
Contrast Ratio	1,200(Typ.)	-	
Response Time	25(Typ.),30(Max.) @25℃	ms	
Input Voltage	3.3(Typ.)	V	
Power Consumption	TBD(Max.) @White pattern, FV=60Hz	W	
Weight(LCM +CG)	871(Max.)	g	
Outline Dimension (H x V)	308.832(Typ.)x132.312(Typ.)	mm	
Thickness	with PCB	9.83(Max.)	mm
	Without PCB	6.56(Typ.)	mm
Electrical Interface (Logic)	LVDS	-	
Support Color	8bit	-	
NTSC	75%(Typ.)	%	
Surface Treatment	HC/3H	-	
Sensor Interface	I ² C	-	
TP Driver/ Sensor Numbers	56x21	-	

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1.4 Functional Block Diagram

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

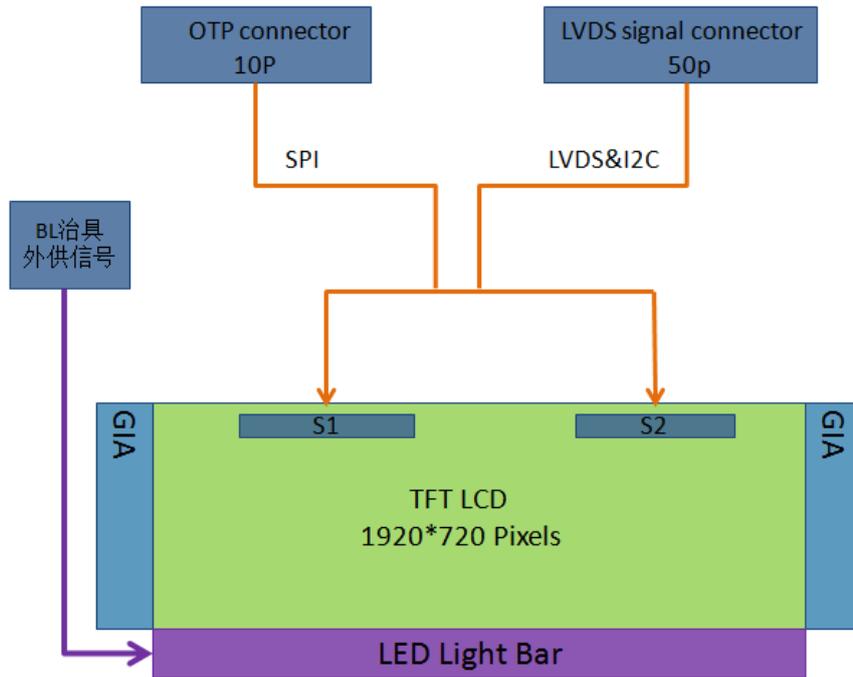


Figure 1 Block Diagram

1.5 Pixel Mapping

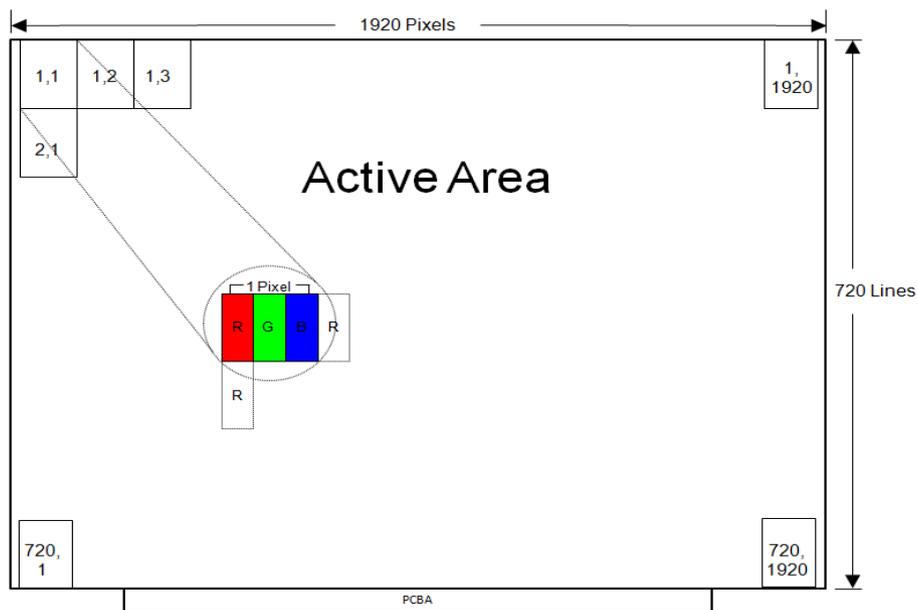


Figure 2 Pixel Mapping

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2.0 Absolute Maximum Ratings

Table 1 Electrical & Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	VSP	5	7	V	(1),(2),(3),(4)
	VSN	-7	-5	V	
	VDD1	2.7	3.6	V	
Logic Input Signal Voltage	V_{Signal}	2.7	3.6	V	
Operating Temperature	T_{gs}	-30	85	°C	
Storage Temperature	T_a	-40	90	°C	

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°C, 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°C, and no condensation of water. Besides, protect the module from static electricity.

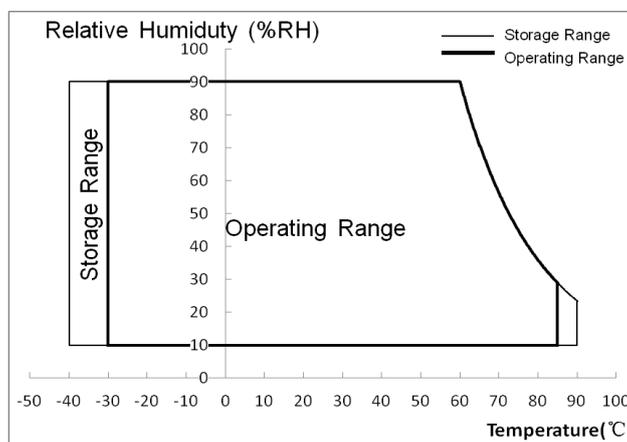


Figure 3 Absolute Ratings of Environment of the LCD Module

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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		900	1,200	-	-	(1),(2),(4),(8) $\theta_x=\theta_y=0^\circ$
Response Time	Rising +Falling	25°C	-	25	30	ms	(1),(2),(5),(8) $\theta_x=\theta_y=0^\circ$
Color Chromaticity (CIE1931)	White x		Typ. -0.04	0.333	Typ. +0.04	-	(1),(2),(3),(8) $\theta_x=\theta_y=0^\circ$
	White y			0.340		-	
	Red x			0.637		-	
	Red y			0.322		-	
	Green x			0.315		-	
	Green y			0.639		-	
	Blue x			0.154		-	
	Blue y			0.064		-	
NTSC(CIE 1931)			70	75	-	%	(1),(2),(3),(8) $\theta_x=\theta_y=0^\circ$
White Luminance	Center Point		850	1,000	-	cd/m ²	(1),(2),(6),(8) $\theta_x=\theta_y=0^\circ$
Luminance Uniformity	9Points		75	80	-	%	(1),(2),(7),(8) $\theta_x=\theta_y=0^\circ$

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Note (1) Measurement Setup:

The LCD module should be stabilized at given temperature (25°C) 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 a windless room.

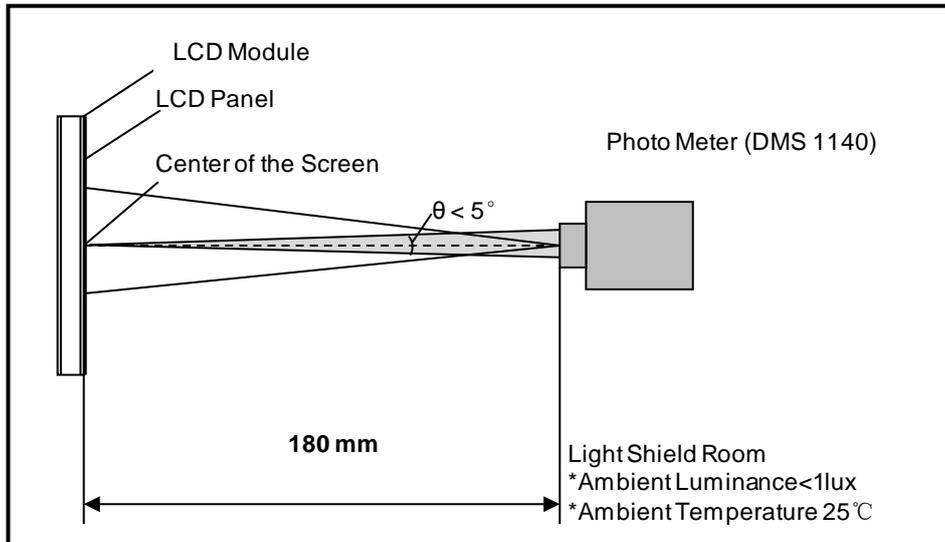


Figure 4 Measurement Setup

Note (2) The Backlight input parameter setting as:

$I_{LED}: 270\text{mA}$

Note (3) Definition of Viewing Angle

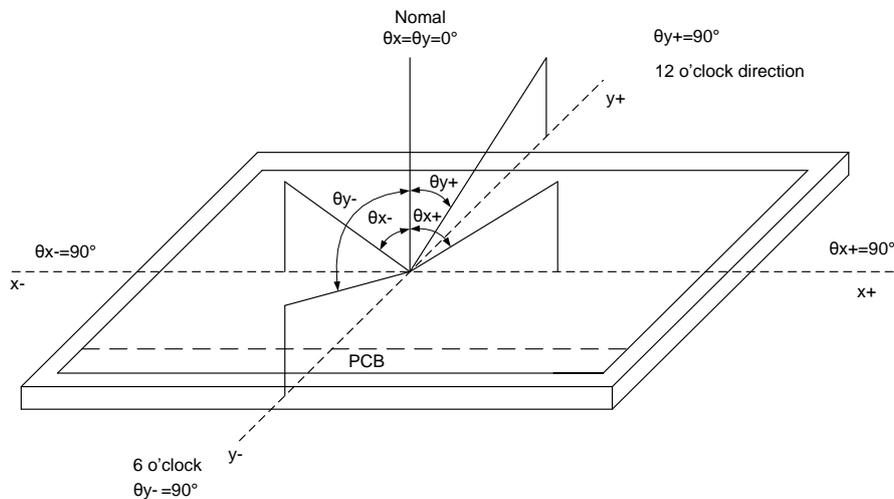


Figure 5 Definition of Viewing Angle

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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)

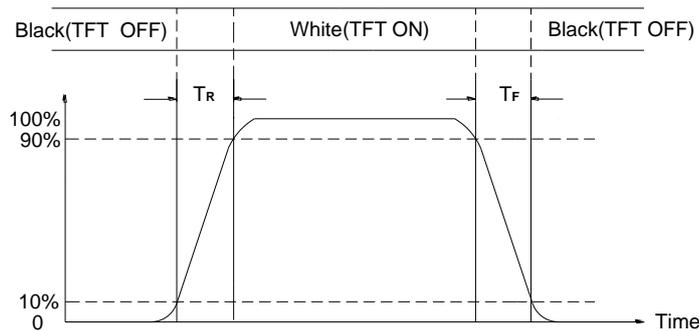


Figure 6 Definition of Response Time

Note (6) Definition of Luminance 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

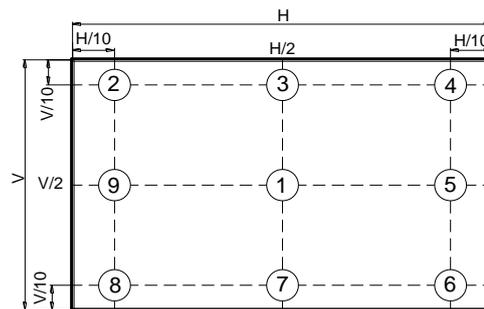


Figure 7 Measurement Locations of 9 Points

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 Characteris

4.1 Interface Connector

Table 3 Signal Connector Type

Item	Description
Manufacturer / Type	STM/ FFSKL05007G50G

Table 4 Signal Connector Pin Assignment

Pin No.	Symbol	Description
1	NC	NC
2	GND	Digital ground
3	DA_P_O	LVDS input
4	DA_N_O	LVDS input
5	GND	Digital ground
6	DB_P_O	LVDS input
7	DB_N_O	LVDS input
8	GND	Digital ground
9	DC_P_O	LVDS input
10	DC_N_O	LVDS input
11	GND	Digital ground
12	CLK_P_O	LVDS input
13	CLK_N_O	LVDS input
14	GND	Digital ground
15	DD_P_O	LVDS input
16	DD_N_O	LVDS input
17	GND	Digital ground
18	DA_P_E	LVDS input
19	DA_N_E	LVDS input
20	GND	Digital ground
21	DB_P_E	LVDS input
22	DB_N_E	LVDS input
23	GND	Digital ground
24	DC_P_E	LVDS input

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25	DC_N_E	LVDS input
26	GND	Digital ground
27	CLK_P_E	LVDS input
28	CLK_N_E	LVDS input
29	GND	Digital ground
30	DD_P_E	LVDS input
31	DD_N_E	LVDS input
32	GND	Digital ground
33	VDD1	Digital power,3.3V
34	VSP	Digital power,6.5V
35	NC	NC
36	VSN	Digital power,-6.5V
37	GND	Digital ground
38	TP_I2C_SDA	I2C interface data signal for touch
39	TP_I2C_SCL	I2C interface Clock signal for touch
40	TP_I2C_INT	Touch screen interrupt line,low active
41	TP_EXT_RSTN	TP external reset signal,low active
42	BIST_EN	Enable BIST Function
43	NC	NC
44	PON	SLPIN/SLPOUT hardware control signal
45	NC	NC
46	FAIL_DET	Fail detection signal output
47	NC	NC
48	NC	NC
49	NC	NC
50	GND	Digital ground
51	GND	Ground
52	DD_CSX	SPI interface input pin
53	DD_SDO	SPI 4-wire interface output pin
54	DD_SDI_SDA	SPI 4-wire interface data input
55	DD_SCL	SPI interface clock signal
56	GND	Ground

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57	OTP_PVPP	EXT Power supply for OTP circuit (7.25V)
58	RSEX	DI-C is initialized when this pin is low
59	NC	NC
60	NC	NC

Table 5 Backlight Connector Type

Item	Description
Mating Receptacle / Type (Reference)	STM/ FFSKL05007G10G

Table 6 LED Connector Pin Assignment

Pin	Symbol	Description
1	LEDA	LED POWER(Anode)
2	LEDA	LED POWER(Anode)
3	LEDA	LED POWER(Anode)
4	NC	NC
5	LEDK	Cathode1
6	LEDK	Cathode2
7	LEDK	Cathode3
8	LEDK	Cathode4
9	NTC_A	NTC(Anode)
10	NTC_K	NTC(Cathode)

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4.2 Signal Electrical Characteristics

4.2.1 Signal Electrical Characteristics For LVDS Receiver

Table 7 LVDS Receiver Input DC Spec

Parameter	Symbol	Min.	Typ.	Max.	Unit
Positive-going input threshold voltage	V_{TH}	-	-	90	mV
Negative-going input threshold voltage	V_{TL}	-90	-	-	mV
LVDS differential voltage	$ V_{ID} $	90	350	800	mV
LVDS input common mode voltage	V_{CMLV}	$0.3+ V_{ID} /2$	-	$2.3- V_{ID} /2$	V

Note:(1)Requirement of termination resistance(Ω): 80(Min.)/100(Typ.)/120(Max).

(2)Test conditions: $V_{CMLV}=1.2V$, $V_{DD1}=2.7V\sim 3.6V$

(3)Test condition: Test point is IC pad.

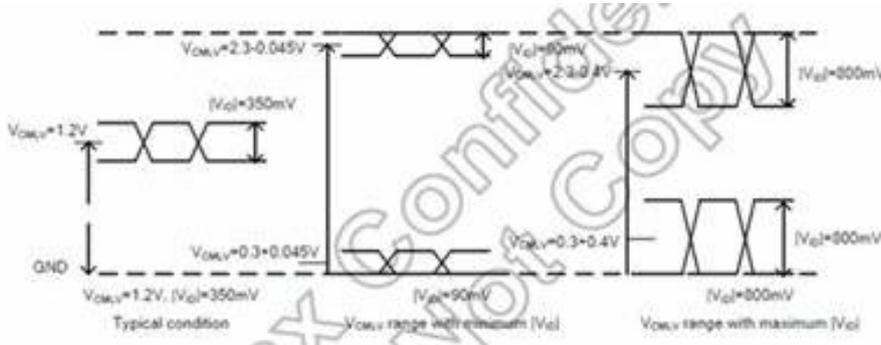


Figure 8 LVDS Receiver Input Signal levels

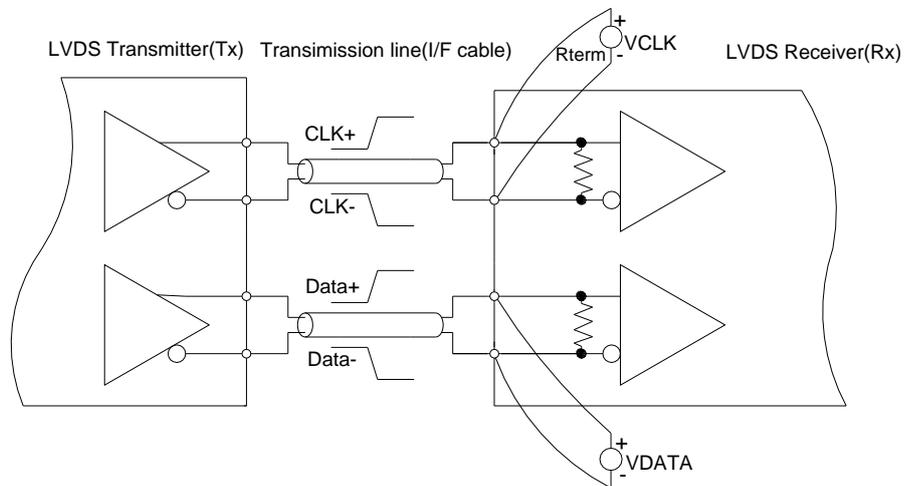


Figure 9 Measurement System

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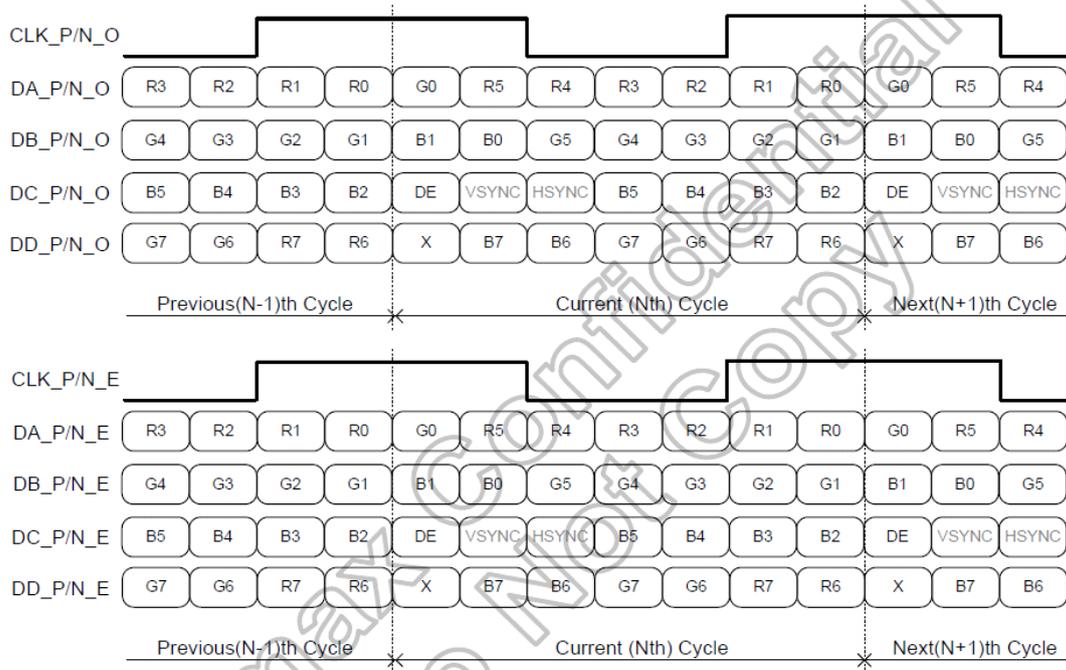


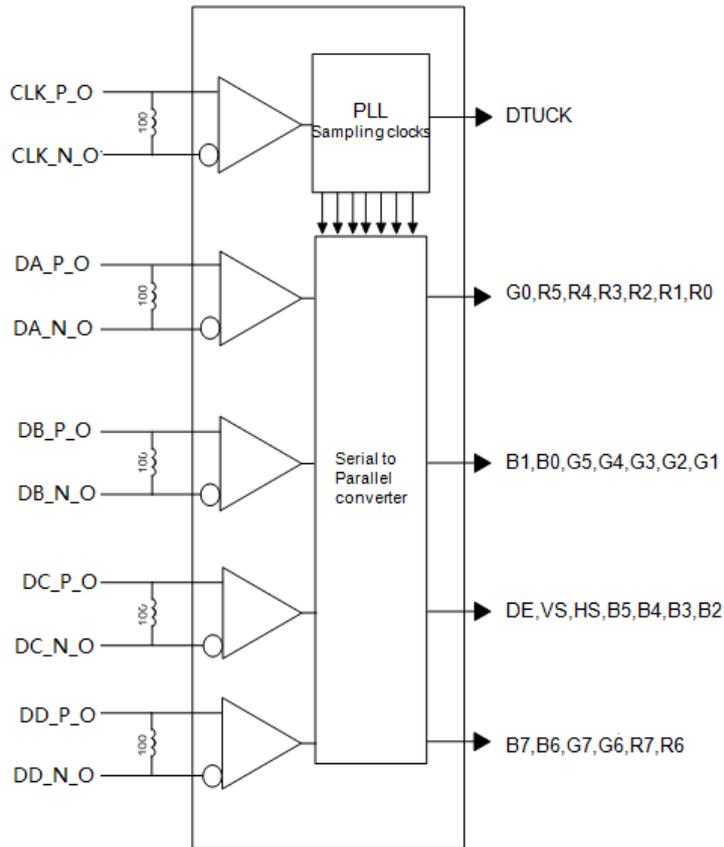
Figure 10 Data Mapping

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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.



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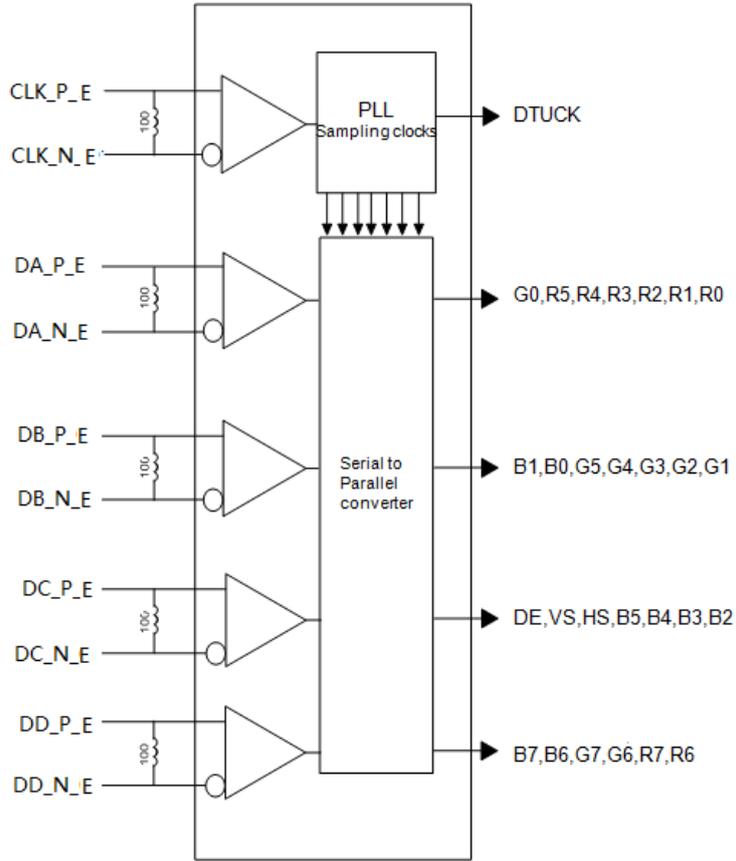


Figure 11 LVDS Receiver Internal Circuit

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4.3 Interface Timings

4.3.1 Timing Characteristics

Table 8 Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
H Total Time	HT	-	2064	-	clocks
H Active Time	HA	1920			clocks
H Front Porch	Thfp	-	56	-	clocks
H Sync Pulse Width	HSPW	-	32	-	clocks
H Back Porch	Thbp	-	56	-	clocks
V Total Time	VT	-	930	-	lines
V Active Time	VA	720			lines
V Front Porch	Tvfp	-	200	-	lines
V Sync Pulse Width	VSPW	-	2	-	lines
V Back Porch	Tvbp	-	8	-	lines
Frame Rate	Vsync	-	60	-	Hz
Pixel Clock Frequency	Fdck	-	115.2	-	MHz

Note: $H \text{ total} * V \text{ total} * \text{Frame Frequency} \leq 115.2 \text{ MHz}$

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4.4 Input Power Specifications

Input power specifications are as follows.

Table 19 Input Power Specifications

Item	Symbol	Min.	Typ.	Max.	Units	Note	
LCD Drive Voltage (Logic)	VCC	3.0	3.3	3.6	V	(1),(2)	
	VSP	5.5	6.5	7.0	V		
	VSN	-7.0	-6.5	-5.5	V		
LCD Current	White Pattern	I _{VCC}	-	116	mA	(1),(3)	
		I _{VSP}	-	71	mA		
		I _{VSN}	-	76	mA		
LCD Power Consumption	P _{LCD}	-	1.34	TBD	mW		
LCD Self Test(BIST)	VIH	V _{BIST}	2.3	-	3.3	V	(1)
	VIL		0	-	1	V	
Horizontal Reverse Scan	VIH	V _{LR}	2.3	-	3.3	V	
	VIL		0	-	1	V	
Vertical Reverse Scan	VIH	V _{UD}	2.3	-	3.3	V	
	VIL		0	-	1	V	
RESET	VIH	V _{RST}	2.3	-	3.3	V	
	VIL		0	-	1	V	
Rush Current	I _{Rush}	-	-	1	A	V	
Allowable Logic/LCD Drive Ripple Voltage	V _{VDD-RP}	-	-	TBD	V		
LED Power Supply							
LED Input Voltage	V _{LED}	-	-	36.3	V	(1),(2),(6)	
LED Power Consumption	P _{LED}	-	-	17.42	W		
LED Forward Voltage	V _F	2.7	-	3.3	V		
LED Forward Current	I _F	-	120	-	mA		
LED Life Time	LT	30,000	-	-	Hrs	(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.

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Note (3) The specified V_{DD} current and power consumption are measured under the $V_{DD1} = 3.3\text{ V}$, $FV = 60\text{ Hz}$ 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.

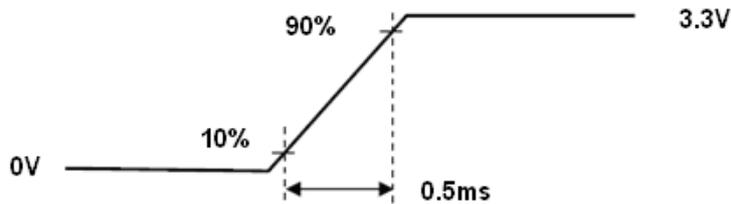
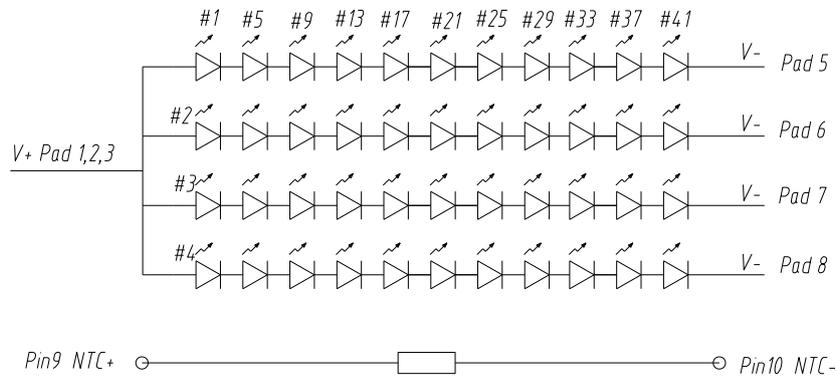


Figure 12 V_{DD} Rising Time

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 50% of the minimum value under normal operating condition.

Note (6) Definition of V_{LED} and P_{LED}

$$V_{LED} = VF \times 11, I_{LED} = IF \times 4, P_{LED} = V_{LED} \times I_{LED}$$



Note (8) The allowable forward current of LED vary with environmental temperature (Type: Murata NCU15XH103F6SRC):

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NTC Temperature VS Allowable LED Current

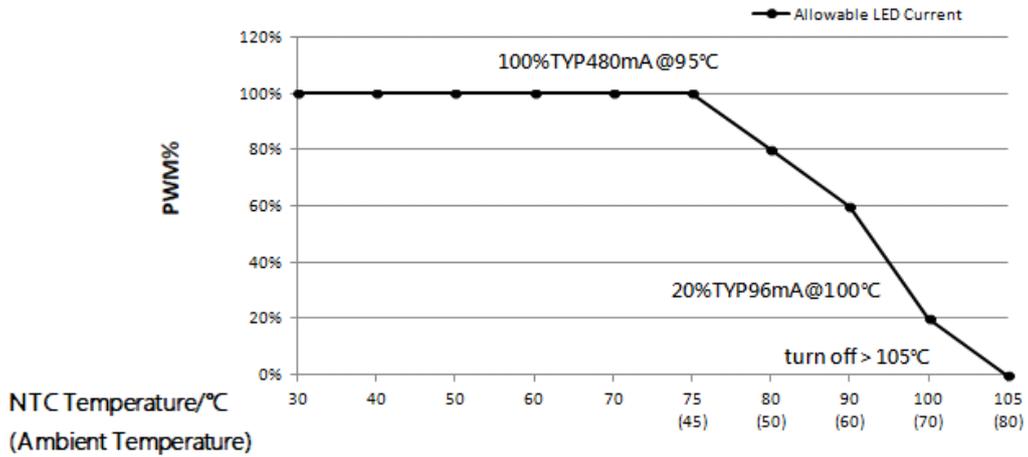


Figure 18 Backlight Current De-rating Curve

Table 9 The relationship of temperature and resistance for NTC

Temperature/°C	Resistance/Kohm	Temperature/°C	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

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50	4.161	150	0.309
55	3.535	-	-

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4.5 Power ON/OFF Sequence

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.

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

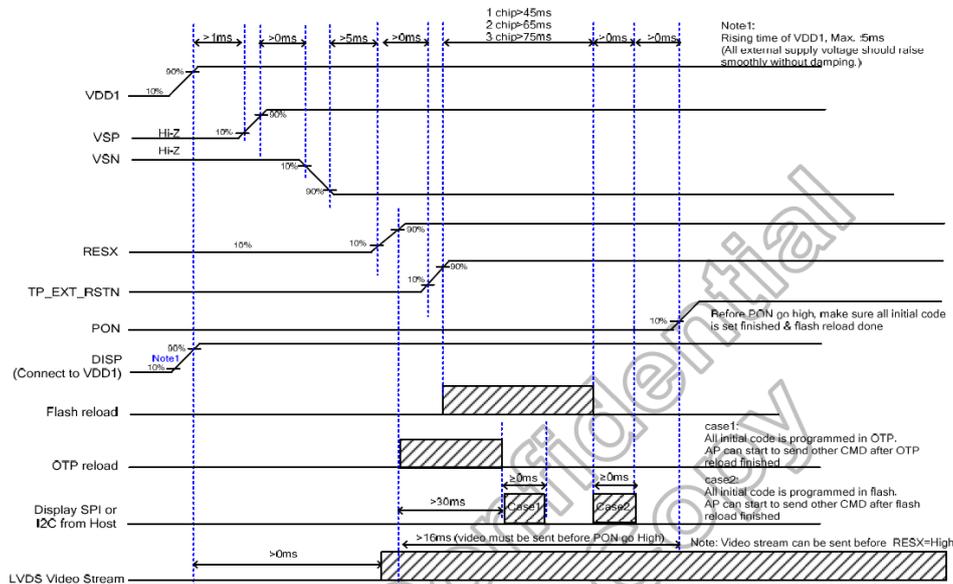


Figure 13 Power on Sequence

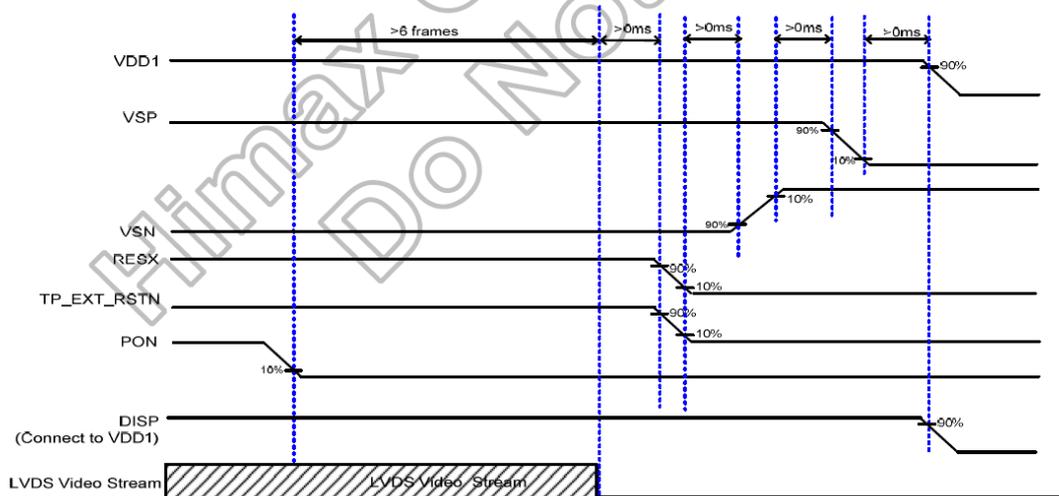


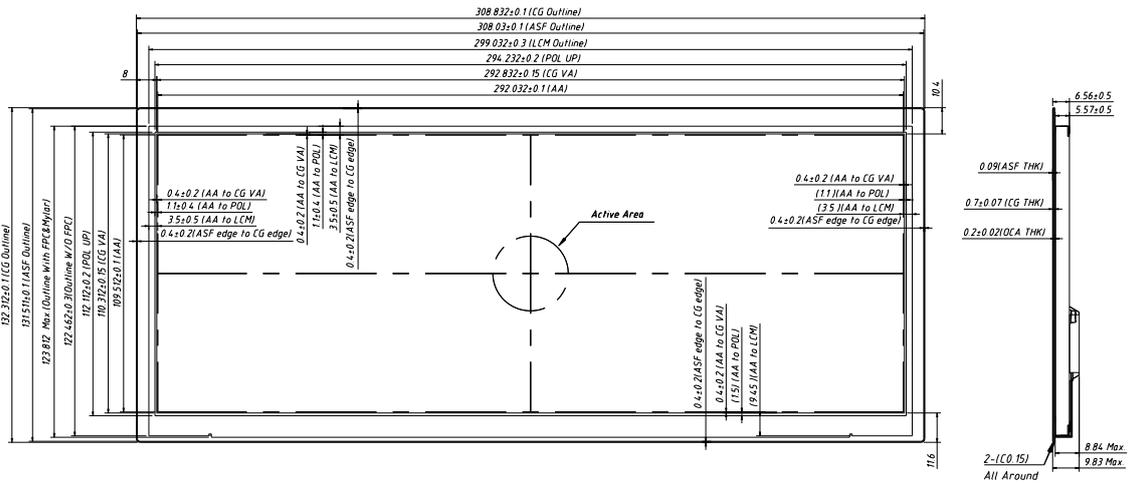
Figure 14 Power off Sequence

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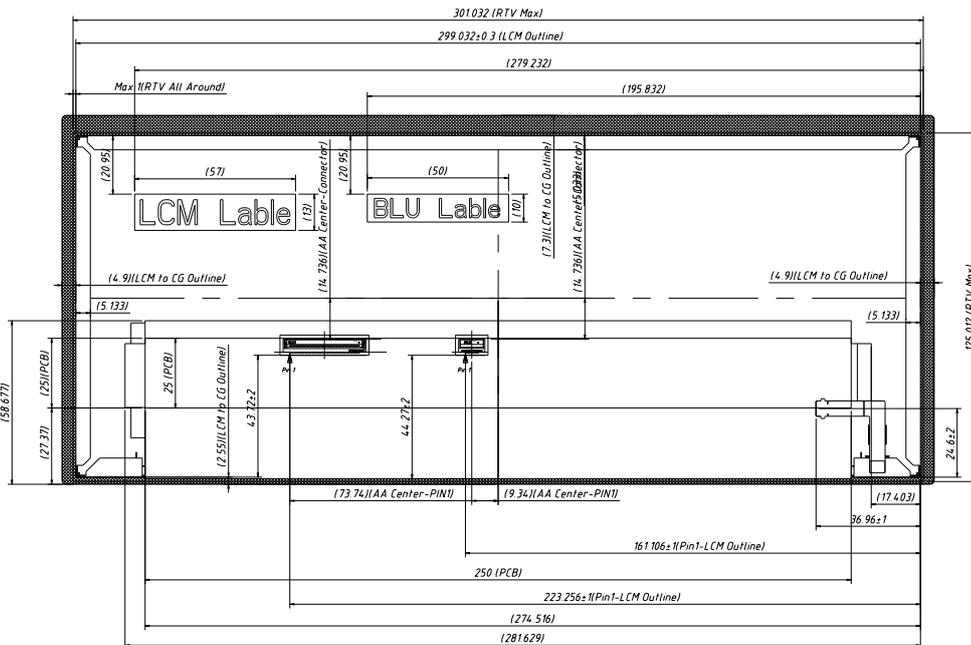
5.0 Mechanical Characteristics

5.1 Outline Drawing



Unit: mm

Figure 15 Reference Outline Drawing (Front Side)



Unit: mm

Figure 16 Reference Outline Drawing (Back Side)

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5.2 Dimension Specifications

Table 10 Module Dimension Specifications

Item	Min.	Typ.	Max.	Units	
Width	308.732	308.832	308.932	mm	
Height	132.212	132.312	132.412	mm	
Thickness	Without PCBA	6.06	6.56	7.06	mm
	With PCBA	-	-	9.83	mm
Weight	-	833.35	871	g	

Note: Outline dimension measure instrument: Vernier Caliper.

6.0 Reliability Conditions

Table 11 Reliability Condition

Item	Package	Test Conditions	Note
High Temp. Operating	Module + CG	$T_{gs}=85^{\circ}\text{C}$, 500hrs	(1),(2),(3),(4)
High Temp. Storage		$T_a=90^{\circ}\text{C}$, 500hrs	(1),(3),(4)
Low Temp. Operating		$T_a=-30^{\circ}\text{C}$, 500hrs	(1),(2),(3),(4)
Low Temp. Storage		$T_a=-40^{\circ}\text{C}$, 500hrs	(1),(3),(4)
High Temp. High Humidity Operating		$T_{gs}=60^{\circ}\text{C}$, 90%RH, 500hrs	(1),(2),(3),(4)
High Temp. High Humidity Storage		$T_{gs}=60^{\circ}\text{C}$, 90%RH, 500hrs	(1),(2),(3),(4)
Thermal Shock Non-operating Test		$-40^{\circ}\text{C} \sim 90^{\circ}\text{C}$, 60min/each cycle, 200cycle	(1),(3),(4)
ESD(Operating)		Contact : $\pm 8\text{KV}$ Air : $\pm 15\text{KV}$ (C=150pF, R=150 Ω) Class C	(1),(2),(6)
Image Sticking		Normal temperature : 25°C , chessboard 10*8 pattern, change to 50% gray pattern; Check Point: 2hrs(release 5min) invisible	(1),(2),(7)

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		High temperature : 65°C , chessboard 10*8 pattern,change to 50% gray pattern; CheckPoint: 2hrs(release 5min) invisible	
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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°C, 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) It is recommended to follow the nominal parameter specified by IVO before the Image Sticking test. Besides, Vcom must be adjusted to optimize display quality.

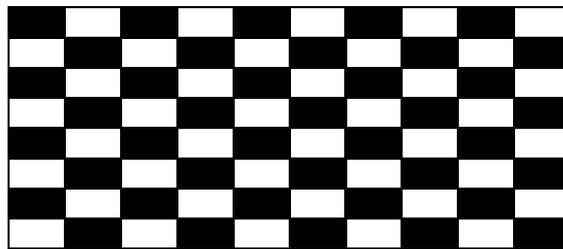


Figure 20 Image Sticking

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7.0 Package Specification

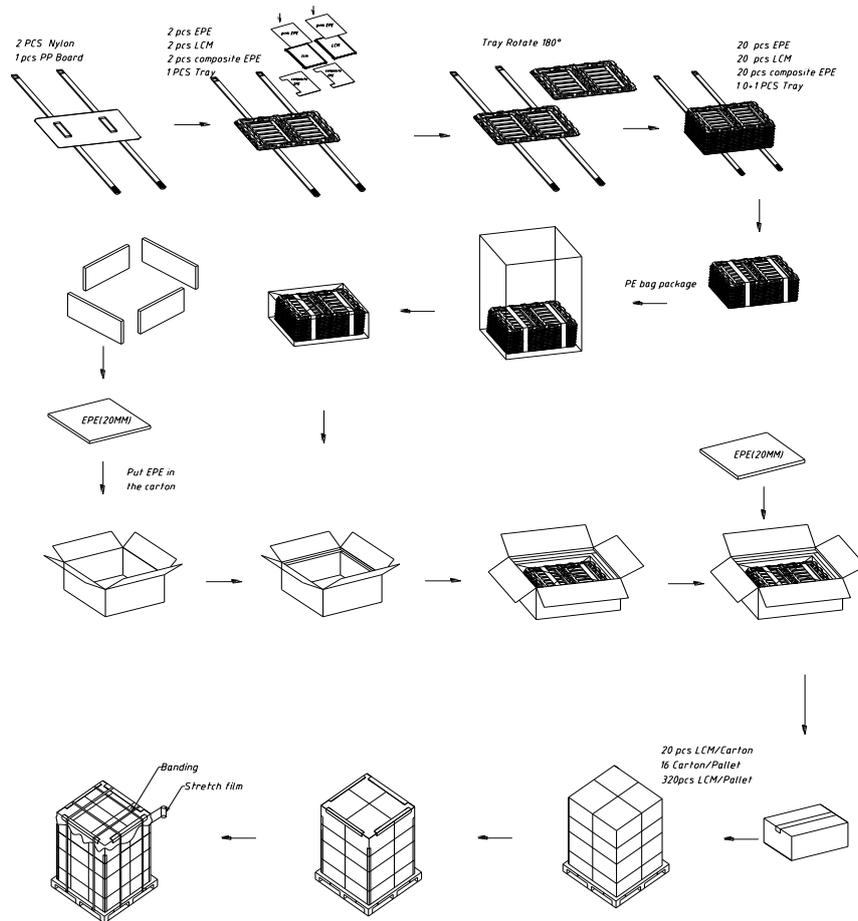


Figure 21 Packing Method

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8.0 Lot Mark

TBD

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9.0 General Precaution

9.1 Use Restriction

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

9.2 Handling Precaution

(1) The LCD product should be operated under normal conditions.

Normal conditions are defined as below:

Temperature: 25°C

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.

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(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) 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°C and 35°C 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.