Tentative Product Specification

To:

Product Name: M101GWT9 RA

Document Issue Date: 2019/08/27

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

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.

Revision	Date	Page	Revised Content/Summary	Remark
00	2019/08/27	--	First issued.	

CONTENTS

1.0 General Descriptions

1.1 Introduction

The M101GWT9 RA 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 10.1 inch diagonally measured active display area with WSVGA resolution (1,024 horizontal by 600 vertical pixels array).

1.2 Features

- Supported WSVGA Resolution
- LVDS Interface
- Compatible with RoHS Standard

1.3 Product Summary

Items		Specifications	Unit
Screen Diagonal		10.1	inch
Active Area (H x V)		222.72 x 125.28	mm
Number of Pixels (H x V)		1,024 x 600	-
Pixel Pitch (H x V)		0.2175 x 0.2088	mm
Pixel Arrangement		R.G.B. Vertical Stripe	-
Display Mode		Normally White	-
White Luminance		800 (Typ.)	cd /m^2
Contrast Ratio		600(Typ.)	-
Response Time		25(Typ.) @25℃	ms
Input Voltage		3.3(Typ.)	V
Power Consumption		8.143	W
Weight		330(max.)	g
Outline Dimension (H x V x D)	W/O FPCA	238.6(Typ.)×148.05(Typ.)×6.5(Typ.)	mm
	With FPCA	238.6(Typ.)×148.05(Typ.)×10.8(Max.)	
Electrical Interface (Logic)		LVDS	-
Support Color		16.7 M	-
NTSC		50(Typ.)	%
Optimum Viewing Direction		12 O'clock	-
Surface Treatment		Anti-glare	-

1.4 Functional Block Diagram

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

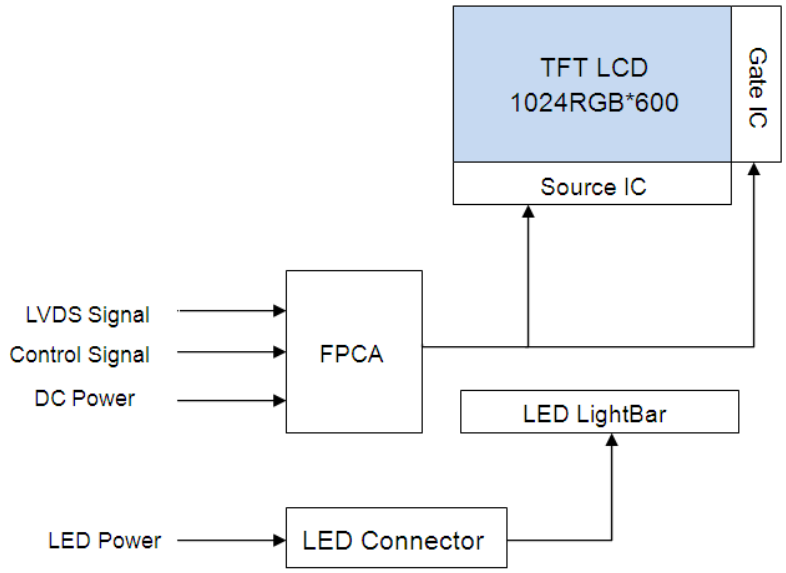


Figure 1 Block Diagram

1.5 Pixel Mapping

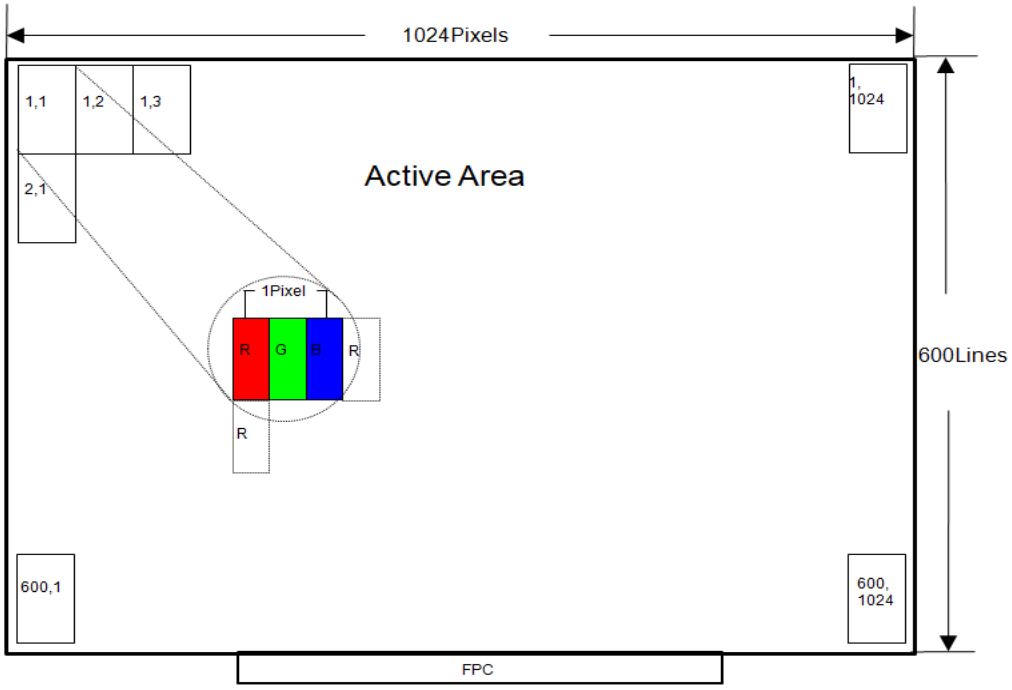


Figure2 Pixel Mapping

2.0 Absolute Maximum Ratings

Table 1 Electrical & Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
LVDS Supply Voltage	VDD	-0.5	3.96	V	(1),(2),(3),(4)
	VDDA	-0.3	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.

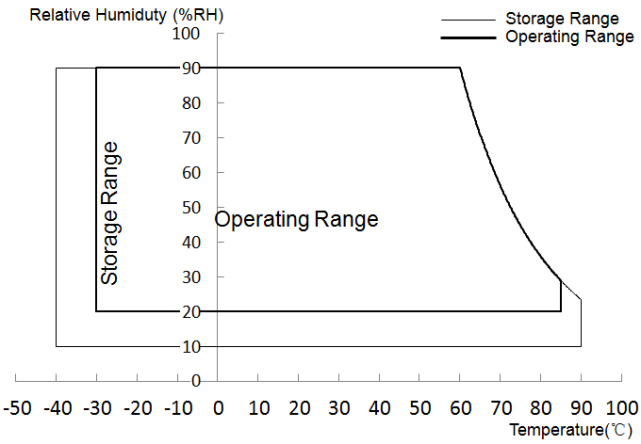


Figure 3 Absolute Ratings of Environment of the LCD Module

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+}	60	70	-	degree	(1),(2),(3),(4),(8)
		θ_{x-}	60	70	-		
	Vertical	θ_{y+}	60	70	-		
		θ_{y-}	40	50	-		
Contrast Ratio	Center		500	600	-	-	(1),(2),(4),(8) θx=θy=0°
Response Time	Rising + Falling	25℃	-	25	40	ms	(1),(2),(5),(8) θx=θy=0°
Color Chromaticity (CIE1931)	Red x		Typ. -0.04	0.594	Typ. +0.05	-	(1),(2),(3),(8) θx=θy=0°
	Red y			0.346		-	
	Green x			0.319		-	
	Green y			0.568		-	
	Blue x			0.152		-	
	Blue y			0.131		-	
	White x		Typ. -0.05	0.305	Typ. +0.05	-	
	White y			0.325		-	
NTSC	-		45	50	-	%	(1),(2),(3),(8) θx=θy=0°
White Luminance	Center Point		520	800	-	cd/m^2	(1),(2),(6),(8) θx=θy=0°
Luminance Uniformity	9 Points		70	80	-	%	(1),(2),(7),(8) θx=θy=0°

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.

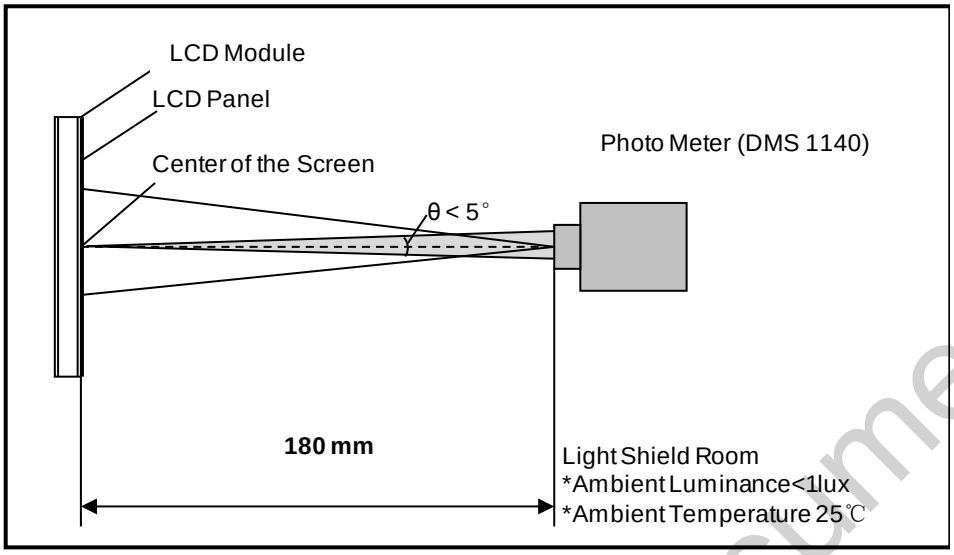


Figure 4 Measurement Setup

Note (2) The LED input parameter setting as:

ILED= 240mA

Note (3) Definition of Viewing Angle

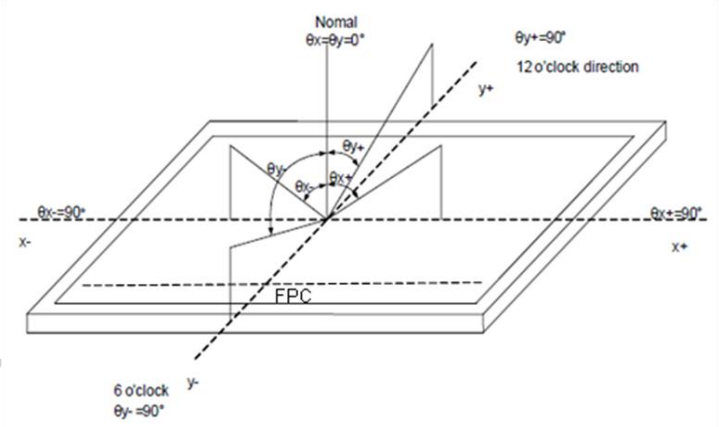


Figure 5 Definition of Viewing Angle

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)

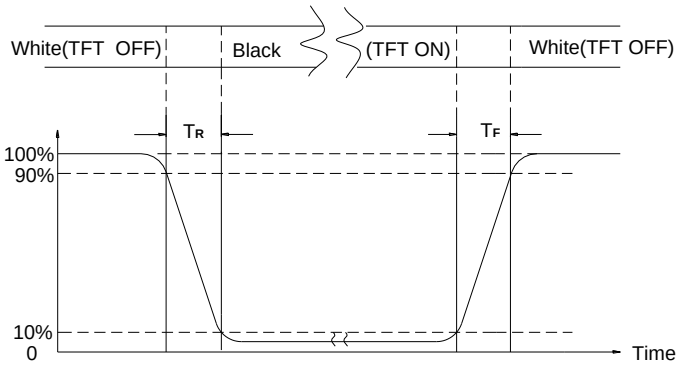


Figure 6 Definition of Response Time

Note (6) Definition of Luminance White

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

Display Luminance=L5（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

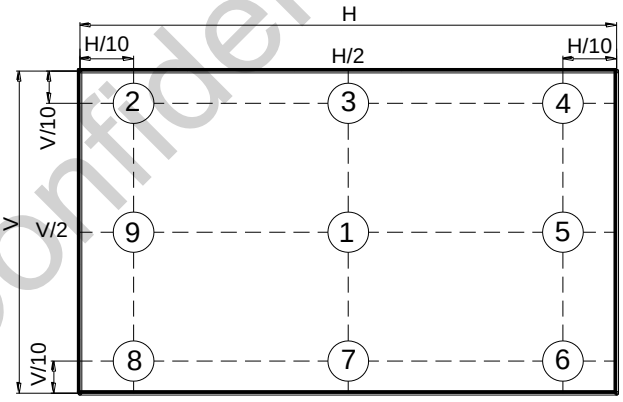


Figure 7 Measurement Locations of 9 Points

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

4.0 Electrical Characteristics

4.1 Interface Connector

Table 3 Signal Connector Type

Item	Description
Mating Receptacle / Type (Reference)	Hirose FH52-40S-0.5SH

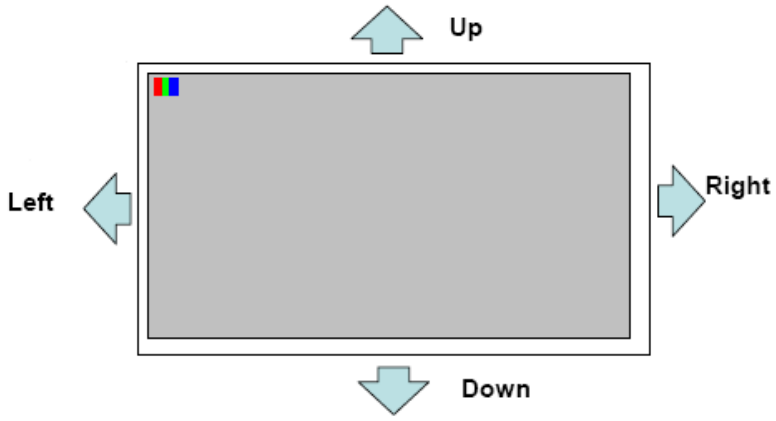
Table 4 Signal Connector Pin Assignment

Pin No.	Symbol	Description	Note.
1	SCL	I2C-Compatible Serial-Clock Input of Digital Vcom	Note2
2	SHLR	Horizontal scan direction control. "H" left to right; "L" right to left	Note1
3	UPDN	Vertical scan direction control. "H" down to up; "L" up to down	Note1
4	VDD	Digital power supply voltage	-
5	GND	Digital Ground	-
6	GRB	Global reset pin. (Low active)	-
7	SDA	I2C-Compatible Serial-Data Input/output of Digital Vcom	Note2
8	GND	Digital Ground	-
9	CLKP	Positive LVDS differential clock input	-
10	CLKN	Negative LVDS differential clock input	-
11	GND	Digital Ground	-
12	PIND0	Positive LVDS differential input	-
13	NIND0	Negative LVDS differential input	-
14	GND	Digital Ground	-
15	PIND1	Positive LVDS differential input	-
16	NIND1	Negative LVDS differential input	-
17	GND	Digital Ground	-
18	PIND2	Positive LVDS differential input	-
19	NIND2	Negative LVDS differential input	-
20	GND	Digital Ground	-
21	PIND3	Positive LVDS differential input	-
22	NIND3	Negative LVDS differential input	-
23	GND	Digital ground	-
24	GND	Digital ground	-
25	VDD	Digital power supply voltage	-
26	VDD	Digital power supply voltage	-

27	GND	Digital ground	-
28	NC	Dummy	-
29	VDDA	Analog power supply voltage	-
30	VDDA	Analog power supply voltage	-
31	VDDA	Analog power supply voltage	-
32	VDDA	Analog power supply voltage	-
33	VDDA	Analog power supply voltage	-
34	NC	Dummy	-
35	GNDA	Analog Ground	-
36	GNDA	Analog Ground	-
37	GNDA	Analog Ground	-
38	GNDA	Analog Ground	-
39	GNDA	Analog Ground	-
40	BIST	Normal operation/BIST pattern select. Normally pull low. When BIST=H: BIST. (CLK input is not needed.) When BIST=L: Normal operation. (Default) Suggest Connecting to GND if not used	-

Note1：UPDN and SHLR control function:

UPDN	SHLR	FUNCTION
0	1	Normal display.(S1-->S1536,G1200-->G1)
0	0	Inverse Left and Right
1	1	Inverse UP and Down
1	0	Inverse Left and Right Inverse UP and Down



Note2：Please customer don't connector any signals or power voltage to SCL & SDA.

Table5 Backlight Connector Type

Item	Description
Manufacture/Tape	JST/BHSR-02VS-1
Mating Receptacle / Type (Reference)	JST/SM02B-BHSS-1 or Compatible

Table 6 Backlight Connector Pin Assignment

Pin No.	Symbol	Description
1	A	Anode
2	K	Cathde

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	R_{XVTH}	-	-	+100	mV	R_{XVCM} =+1.2V
Differential Input Low Threshold	R_{XVTL}	-100	-	-	mV	-
Magnitude Differential Input	$\|V_{ID}\|$	250	-	600	mV	-
Common Mode Voltage	R_{XVCM}	|VID|/2	-	VDD-1.2	V	-

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.

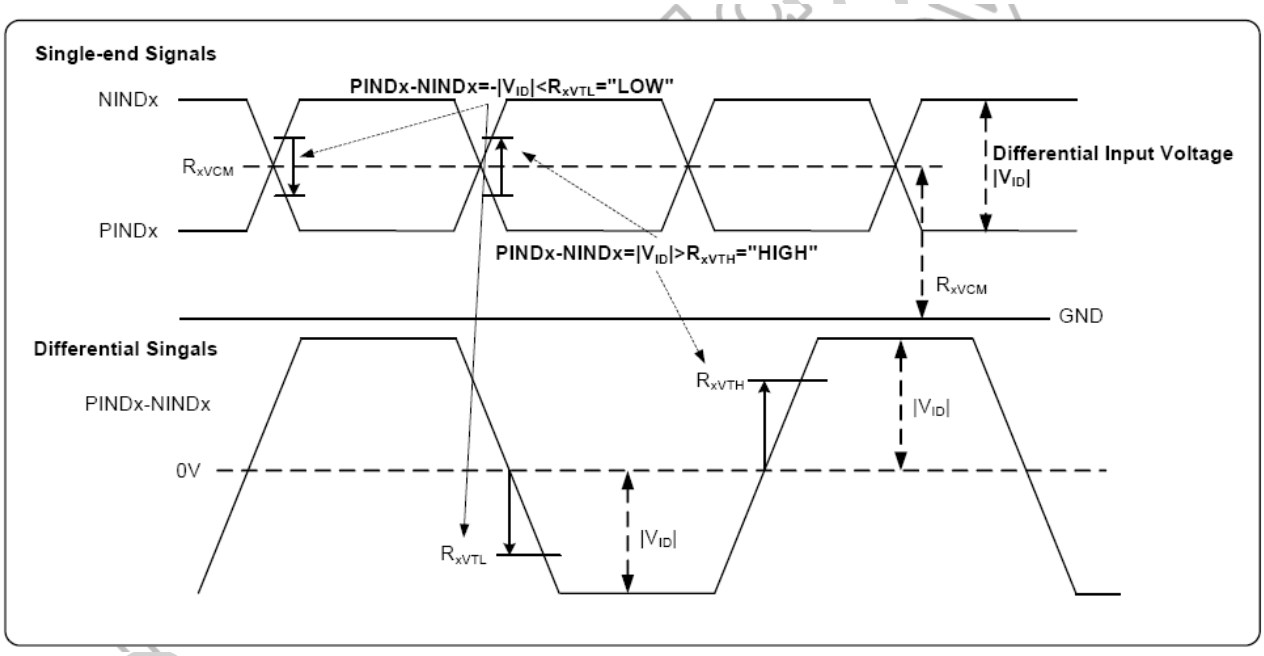


Figure 8 Voltage Definitions

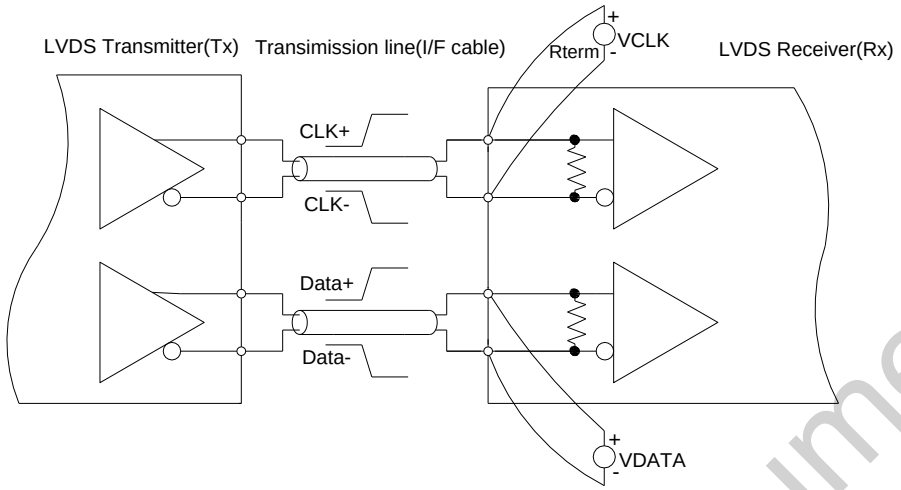


Figure 9 Measurement System

Single 8 bit LVDS input

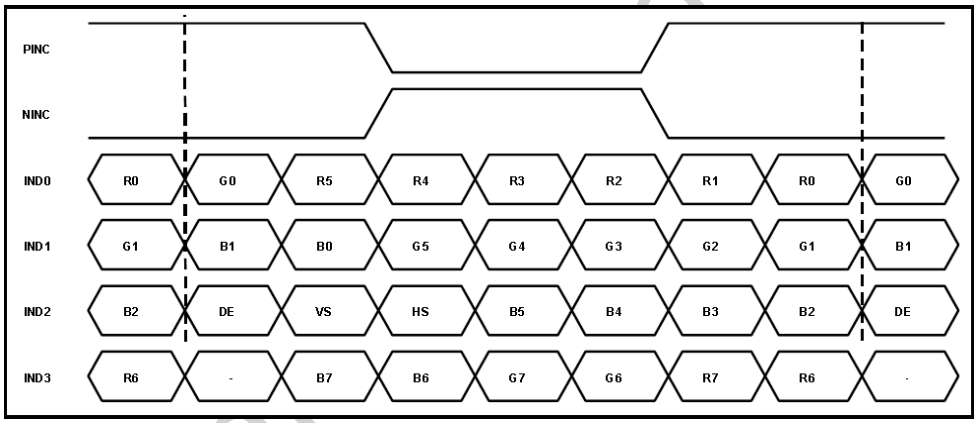


Figure 10 Data Mapping

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.

8bit

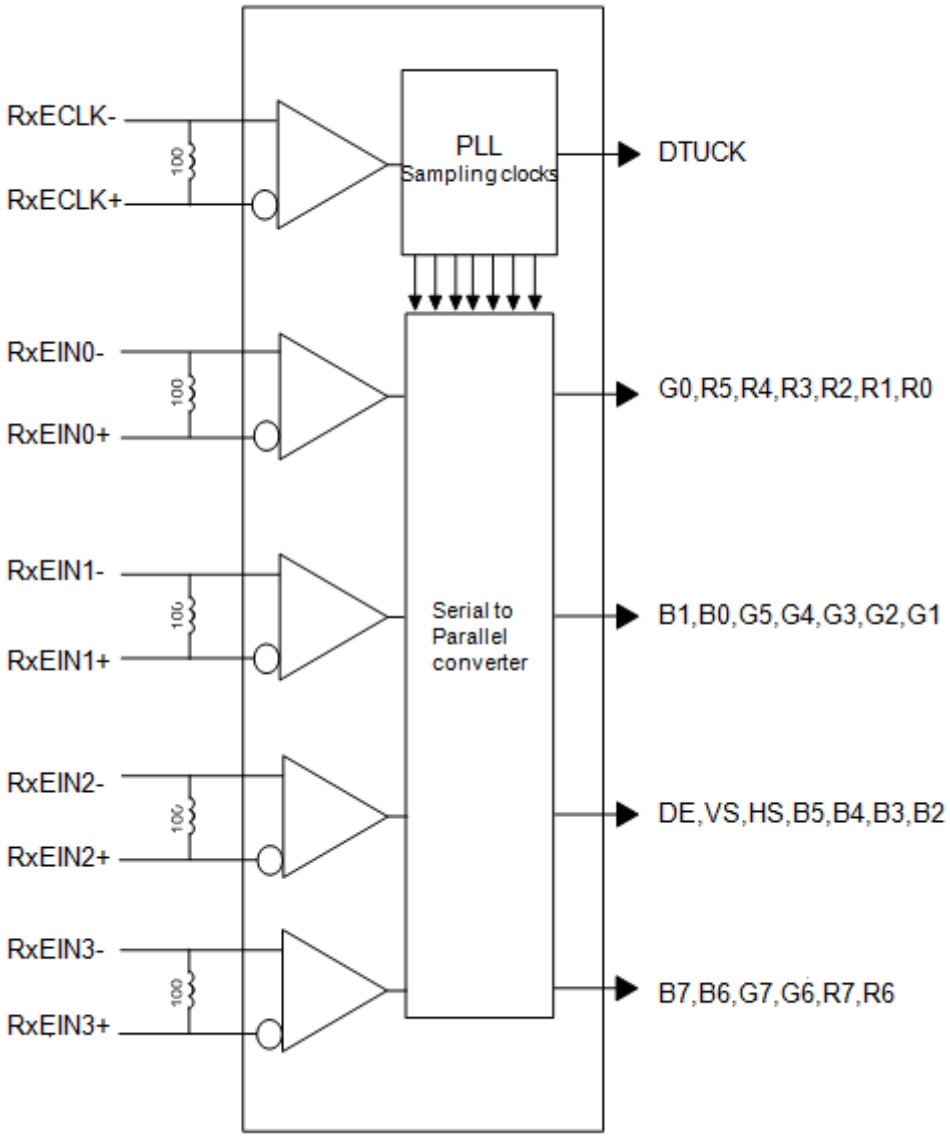


Figure 11 LVDS Receiver Internal Circuit

4.3 Interface Timings

Table 8 Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
LVDS Clock Frequency<dual>	F_{CLK}	45	51.2	57	MHz
Horizontal Total Time	T_{HP}	1324	1344	1364	clocks
Horizontal Active Time	HA		1024		clocks
HSYNC Blanking	TH_{BLANK}	300	320	340	clocks
Vertical Total Time	T_{VP}	625	635	645	clocks
Vertical Active Time	VA		600		lines
VSYNC Blanking	TV_{BLANK}	25	35	45	lines
Frame Rate	F_V	53	60	65	Hz

Note1：HT * VT *Frame Frequency≤57 MHz

Note2: All reliabilities are specified for timing specification based on refresh rate of 60Hz. M101GWT9 RA is secured only for function under lower refresh rate; 60Hz at Normal mode. 53Hz at Power save mode. Don’t care flicker level(power save mode)

Note3: When frame rate at 53Hz may cause screen flicker.

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							
Power Supply Input Voltage		VDD	3.0	3.3	3.6	V	(1),(2)
		VDDA	3.0	3.3	3.6	V	
Power Supply Input Current	Black Pattern	I_{VDD}	-	-	25	mA	(1),(3)
		I_{VDDA}	-	-	200	mA	
Power Consumption	Black Pattern	P_{total}	-	-	743	mW	
Logic Input Signal High Level Voltage		VIH	3.0	3.3	3.6	V	(1) ,(4)
Logic Input Signal Low Level Voltage		VIL	0	-	0.5	V	
Differential Impedance		Zm	90	100	110	Ω	(5)
LED Power Supply							
LED Input Voltage		V_{LED}	(23.4)	-	(30.6)	V	(1) ,(2),(7)
LED Power Consumption		P_{LED}	-	-	7.4	W	(1),(2) ,(7)
LED Forward Voltage		V_F	2.6	-	3.4	V	(1),(2) ,(7)
LED Forward Current		I_F	-	80	-	mA	
LED Life Time		LT	30000	-	-	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_{DVDD} current and power consumption are measured under the V_{DD} = 3.3 V, FV= 60 Hz condition and Black Pattern.

Note (4) Logic input signal include SCL、SHLR、UPDN 、GRB 、SDA 、BIST .

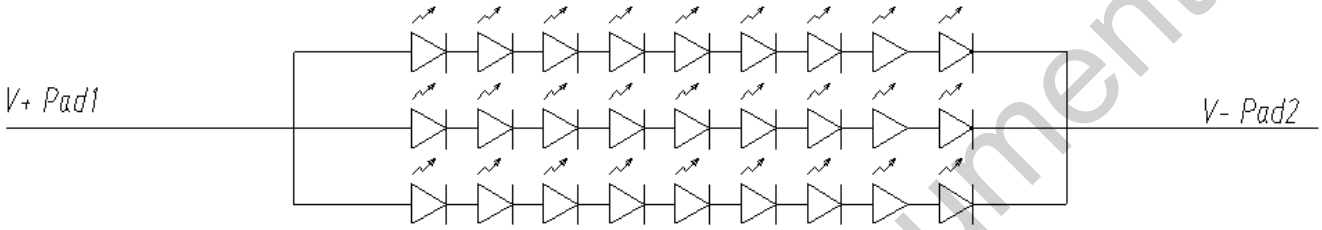
Note (5)This impedance value is needed for proper display and measured from LVDS Tx to the

mating connector.

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

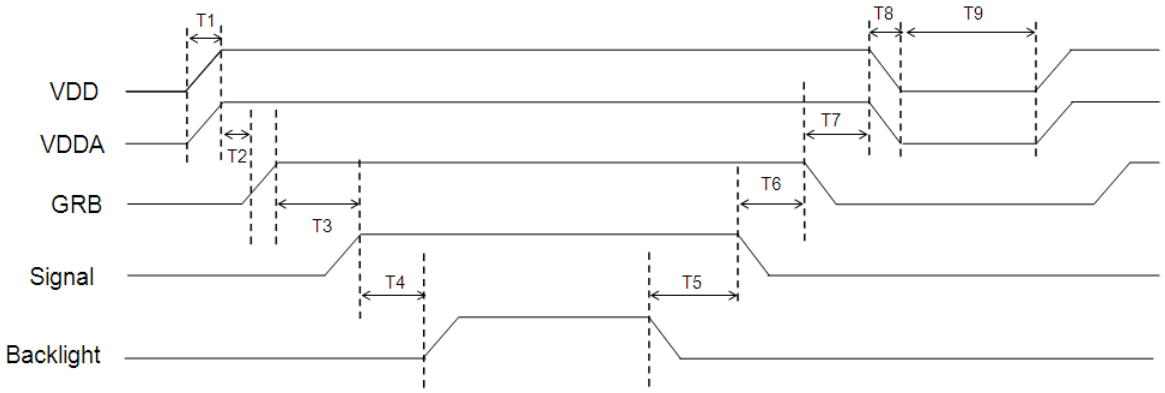
$V_{LED} = V_F \times 9$, $I_{LED} = I_F \times 3$, PLED = $V_{LED} \times I_{LED}$



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.



Power On: VDD/VDDA→GRB→ Video & Logic Signal→Backlight

Power Off: Backlight→ Video & Logic Signal→GRB →VDD/VDDA

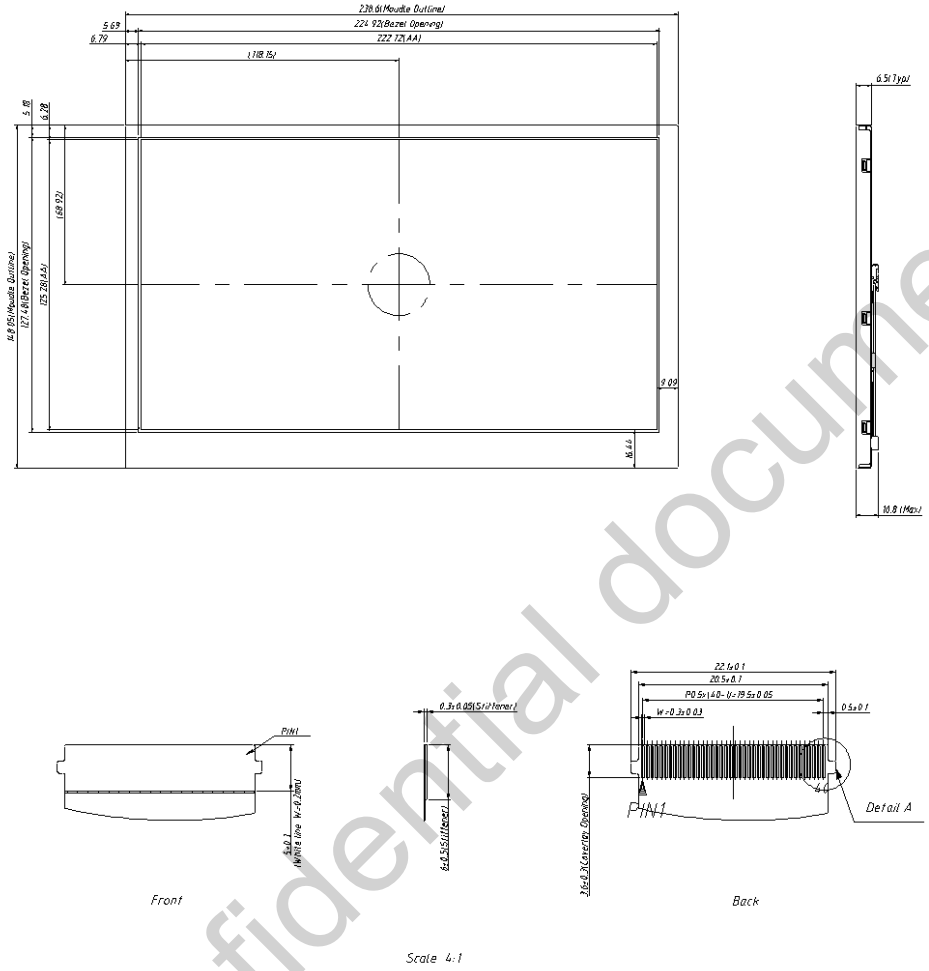
Figure 12 Power Sequence

Table 10 Power Sequencing Requirements

Parameter	Symbol	Min.	Typ.	Max.	Unit
VDD/VDDA Rising Time	T1	ms	10	-	15
VDD/VDDA Good to GRB	T2	ms	1	-	-
GRB Good to Signal Valid Data	T3	ms	1	-	10
Signal Valid to Backlight On	T4	ms	300	350	-
Backlight off to Signal Disable	T5	ms	90	100	--
Signal Disable to GRB Disable	T6	ms	1	-	10
GRB Disable to VDD/VDDA off	T7	ms	1	-	10
VDD/VDDA Falling Time	T8	ms	1	-	10
VDD/VDDA Resettle Time	T9	ms	500	-	-

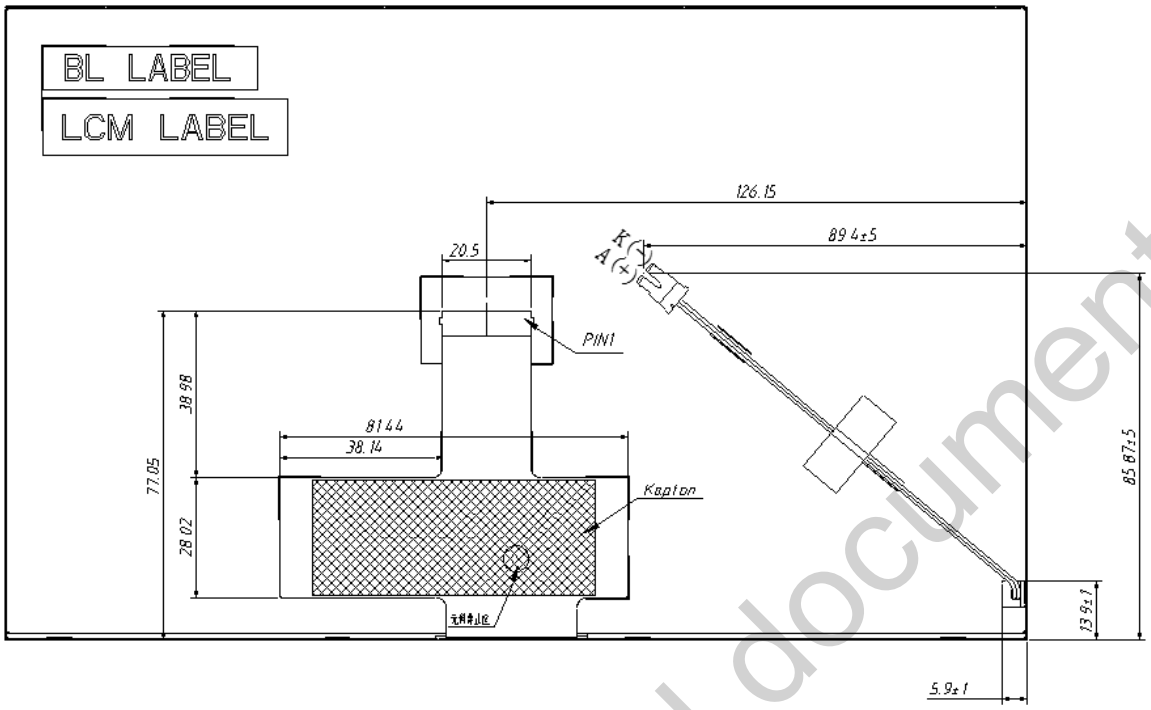
5.0 Mechanical Characteristics

5.1 Outline Drawing



Unit: mm

Figure 13 Reference Outline Drawing (Front Side)



Unit: mm

Figure 14 Reference Outline Drawing (Back Side)

Note: The unmarked tolerance is ±0.5mm

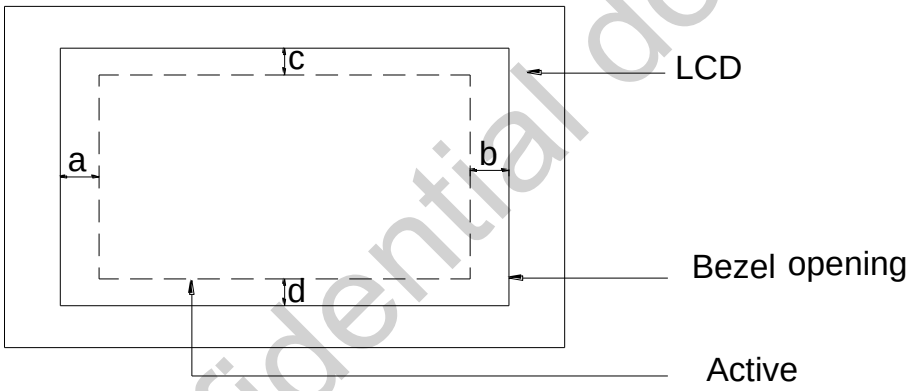
5.2 Dimension Specifications

Table 11 Module Dimension Specifications

Item		Min.	Typ.	Max.	Unit
Width		238.1	238.6	239.1	mm
Height (W/O Tape)		147.55	148.05	148.55	mm
Thickness	W/O FPCA	-	6.5	-	mm
	With FPCA	-	-	10.8	mm
Weight		-	-	330	g
BM: | a-b | & | c-d |		-	-	≤1.0	mm

Note：1.Outline dimension measure instrument: Vernier Caliper.

Figure 15 BM Area



6.0 Reliability Conditions

Table 12 Reliability Condition

Item		Package	Test Conditions	Note
High Temperature/High Humidity Operating Test		Module	T_{gs}= 60℃,90%RH,500hrs	(1),(2),(3),(4)
High Temperature Operating Test			T_{gs}= 85°C,500hrs	
Low Temperature Operating Test			T_a=-30°C,500hrs	
Thermal Cycle			85℃(Operating)→60℃,90%RH(Operating)→-30℃(Operating)→90℃(Non-operating)→60℃,90%RH(Non-operating)→-40℃(Non-operating), 76hrs/cycle,2cycles	
Thermal Shock Non-operating Test			-40℃-90℃, 60min/each cycle,250 cycles	(1),(3),(4)
High Temperature Storage Test			T_a= 90°C,500hrs	(1),(3),(4)
Low Temperature Storage Test			T_a=-40°C,500hrs	
Shock Non-operating Test			100G,6ms,sin wave,±XYZ×3times,Total 18times	(1),(3),(5)
Vibration Non-operating Test			half-sine Frequency: 8 Hz ~ 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		Air:±15KV; Contact:±8KV (C=150pF,R=330Ω)	(1),(2),(6)
	Non-Operating		Air:±20KV;Contact:±10KV (C=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 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

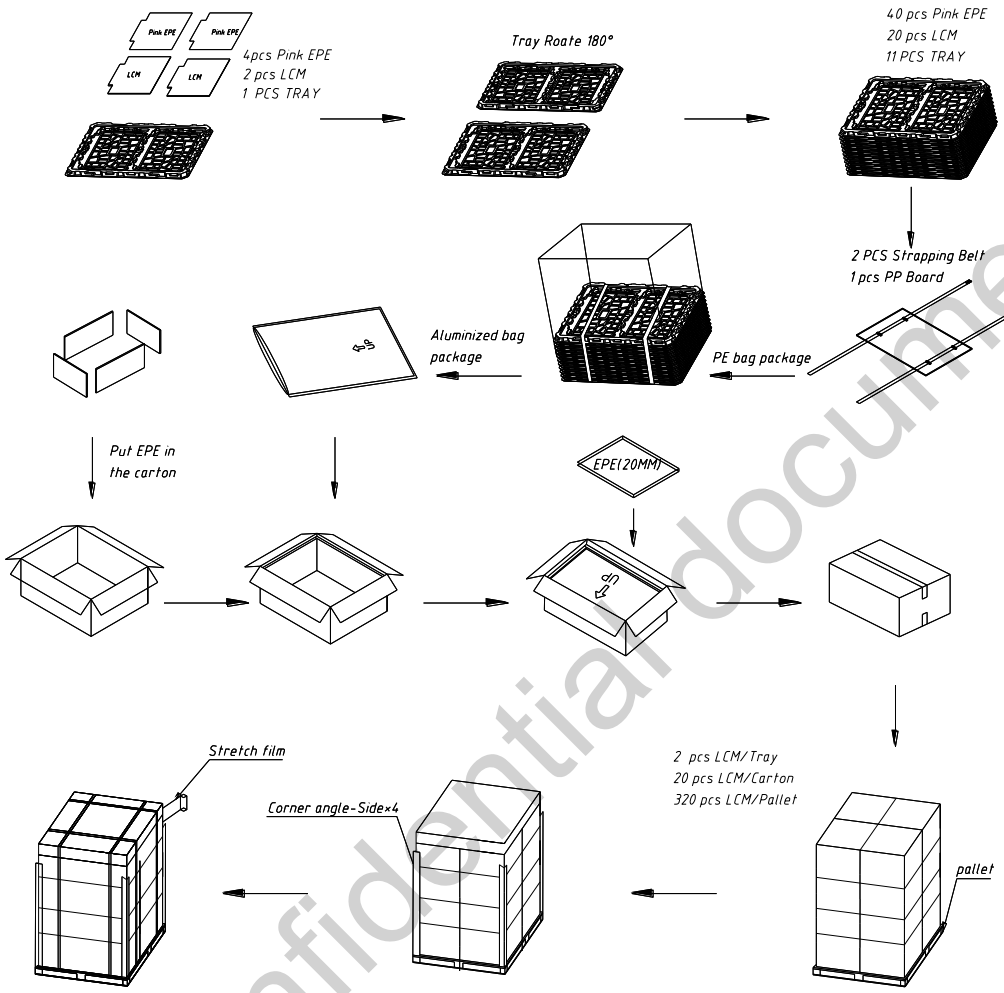
defined as follow: Temperature: 25℃, Humidity: 55± 10%RH. T_a= Ambient Temperature, T_{gs}= Glass Surface Temperature.

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

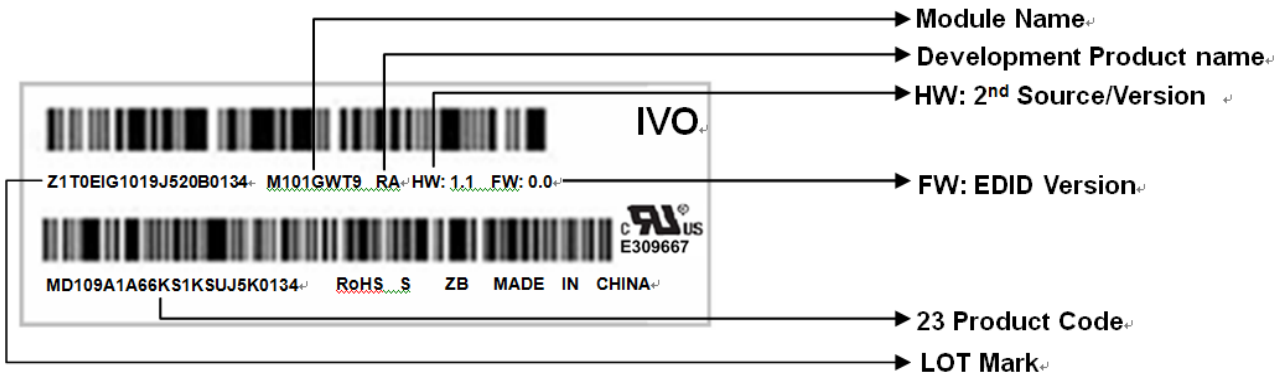
Note (6) It could be regarded as pass, when the module recovers from function fault caused by ESD after resetting.

7.0 Package Specification

Figure 16 Packing Method



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.

Note (1) Production Year

Year	2,006	2,007	2,008	2,009	2,010	2,011	2,012	2,013	……	2,035
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

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) 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.