Customer Approved Specification

To: 深圳龙腾东方光电有限公司

Product Name: M101GWWF R0

Document Issue Date: 2020/09/29

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	2020/09/29	--	First issued.	

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1.0 General Descriptions

1.1 Introduction

The M101GWWF 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 10.1 inch diagonally measured active display area with WXGA resolution (1，280horizontal by 800 vertical pixels array).

1.2 Features

- Supported WXGA resolution
- LVDS Interface
- Wide View Angle
- Compatible with RoHS Standard

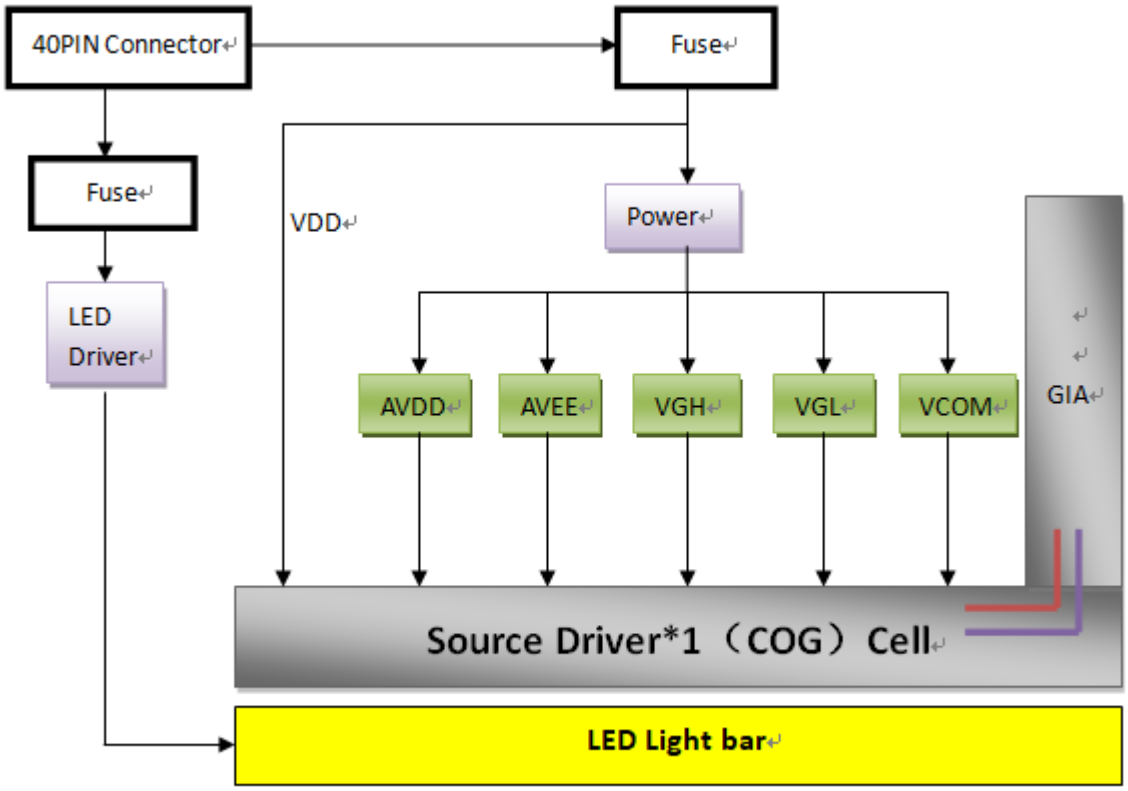
1.3 Product Summary

Items		Specifications	Unit
Screen Diagonal		10.1	inch
Active Area (H x V)		216.96 x135.60	mm
Number of Pixels (H x V)		1,280×800	-
Pixel Pitch (H x V)		0.1695×0.1695	mm
Pixel Arrangement		RGB Vertical Stripe	-
Display Mode		Normally Black	-
White Luminance		350 (Typ.)	cd /m^2
Contrast Ratio		800 (Typ.)	-
Response Time		25 (Typ.)	ms
Input Voltage		3.3 (Typ.)	V
Power Consumption		3.5 (Max.) @White Pattern	W
Weight		165(Max.)	g
Outline Dimension (H x V x D)	Without PCB	229.46 (Typ.) x 149.1(Typ.) x 2.8 (Max.)	mm
	With PCB	229.46 (Typ.) x 149.1(Typ.) x 4.56 (Max.)	
Electrical Interface (Logic)		LVDS	-
Support Color		16.7 M	-
NTSC		45 (Typ.)	%
Optimum Viewing Direction		All	-
Surface Treatment		Glare ,Hard-Coating 3H	-

1.4 Functional Block Diagram

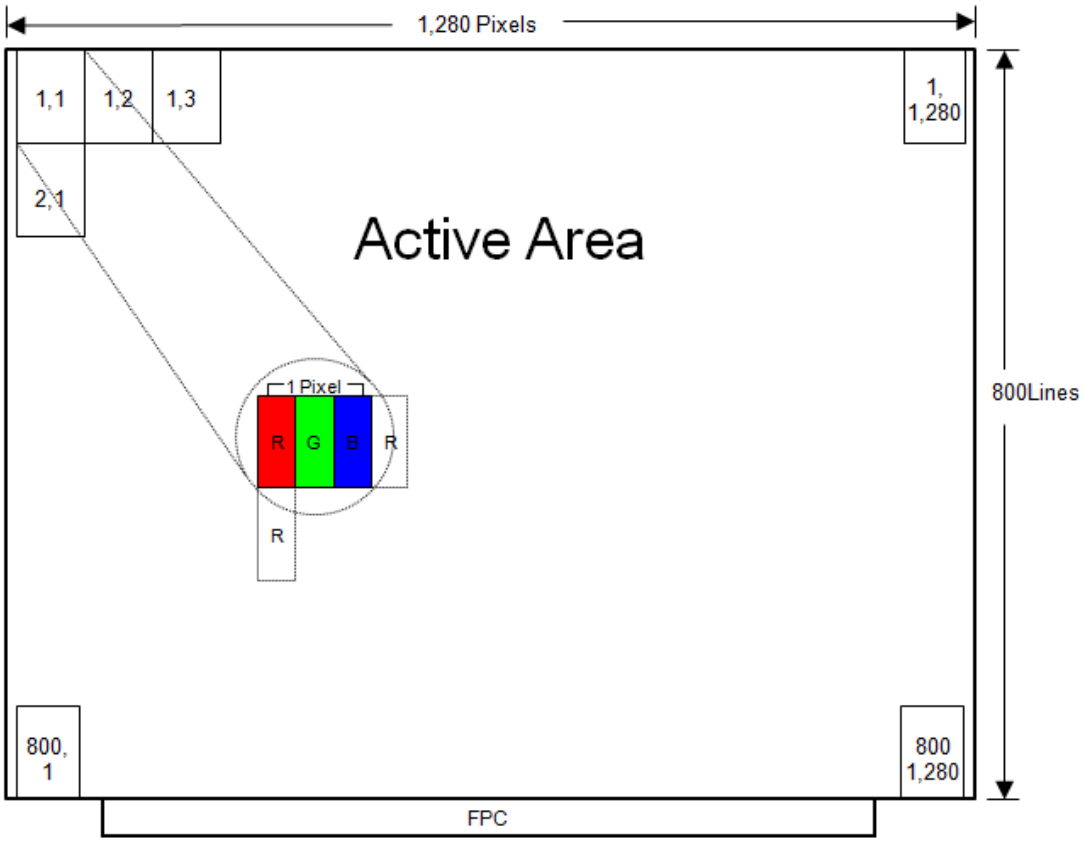
Figure 1 shows the functional block diagram of the LCD module.

Figure 1 Block Diagram



1.5 Pixel Mapping

Figure 2 Pixel Mapping



2.0 Absolute Maximum Ratings

Table 1 Electrical & Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	VDD	-0.3	4	V	(1)(2)(3)(4)
Logic Input Signal Voltage	V_{Signal}	-0.3	4	V	
Operating Temperature	T_{gs}	-20	70	℃	
Storage Temperature	T_a	-30	80	℃	

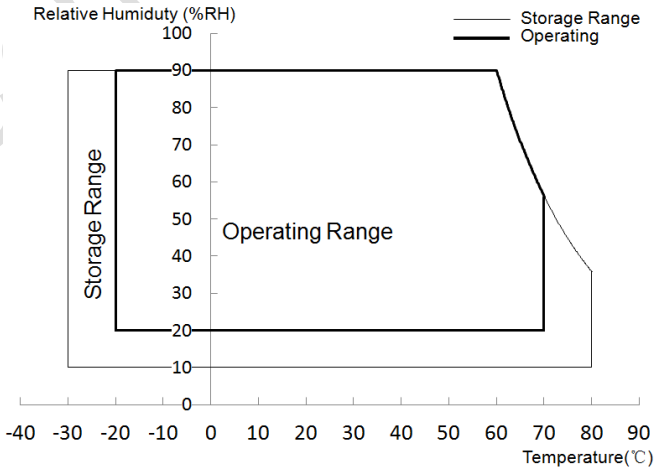
Note(1) All the parameters specified in the table are absolute maximum rating values that may cause faulty operation or unrecoverable damage, if exceeded. It is recommended to follow the typical value.

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. Ta= 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.

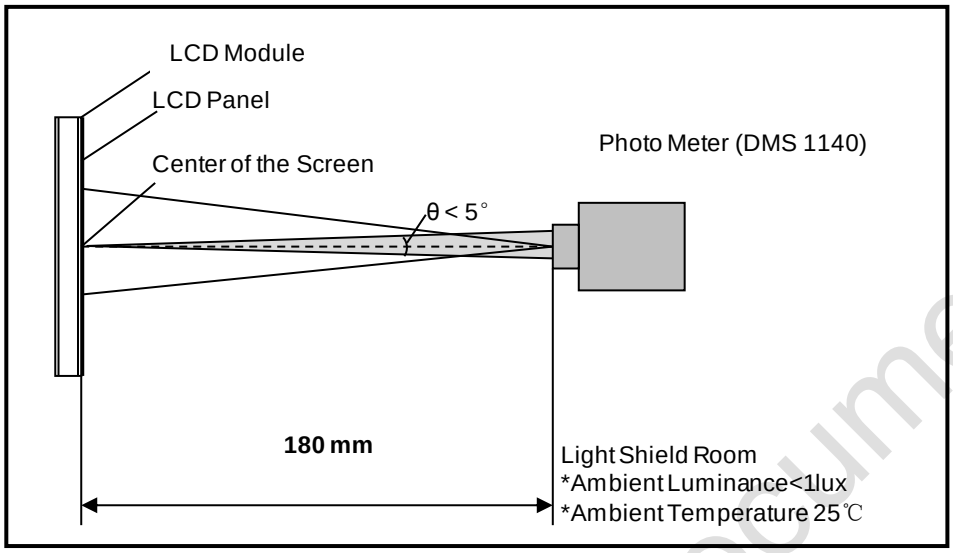
Table 2 Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle （CR≥10）	Horizontal	θ_{x+}	75	85	-	degree	(1),(2),(3),(4),(8)
		θ_{x-}	75	85	-		
	Vertical	θ_{y+}	75	85	-		
		θ_{y-}	75	85	-		
Contrast Ratio	Center		600	800	-	-	(1),(2),(4),(8) θx=θy=0°
Response Time	Rising + Falling		-	25	50	ms	(1),(2),(5),(8) θx=θy=0°
Color Chromaticity (CIE1931)	Red x		Typ. -0.03	0.579	Typ. +0.03	-	(1),(2),(3),(8) θx=θy=0°
	Red y			0.346		-	
	Green x			0.336		-	
	Green y			0.574		-	
	Blue x			0.167		-	
	Blue y			0.133		-	
	White x			0.313		-	
	White y			0.329		-	
NTSC	-		42	45	-	%	(1),(2),(3),(8) θx=θy=0°
White Luminance	Center		300	350		cd/m^2	(1),(2),(6),(8) θx=θy=0°
Luminance Uniformity	9 Points		70	75	-	%	(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



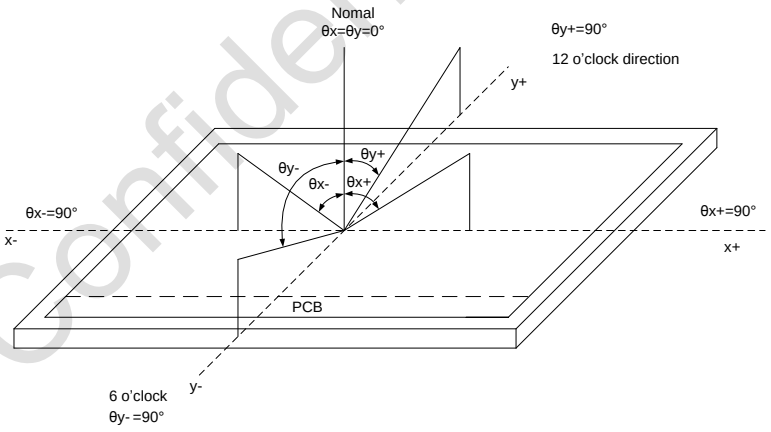
Note(2) The LED input parameter setting as:

V_{LED}: 12 V

PWM_LED: Duty 100 %

Note(3) Definition of Viewing Angle

Figure 5 Definition of Viewing Angle



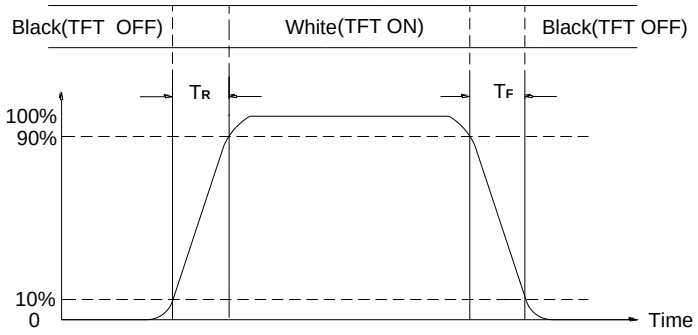
Note(4) Definition of Contrast Ratio (CR)

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)

D isplay Luminance=L1(center point)

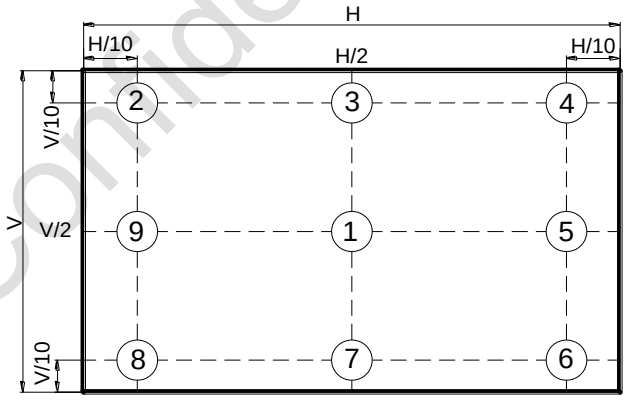
Note(7) Definition of Luminance Uniformity (Ref.: Active Area)

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.

4.0 Electrical Characteristics

4.1 Interface Connector

Table 3 Signal Connector Type

Item	Description
Manufacturer / Type	IPEX / 20455-040E-66

Table 4 Signal Connector Pin Assignment

Pin No.	Symbol	Description	Remarks
1	NC	No Connection	-
2	VDD	Power supply	-
3	VDD	Power supply	-
4	VDD_EDID	VDD_EDID	
5	SCL_EDID	SCL_EDID	
6	SDA_EDID	SDA_EDID	
7	NC	No Connection	-
8	LV0N	-LVDS Differential Data Input	-
9	LV0P	+LVDS Differential Data Input	-
10	GND	Ground	-
11	LV1N	-LVDS Differential Data Input	-
12	LV1P	+LVDS Differential Data Input	-
13	GND	Ground	-
14	LV2N	-LVDS Differential Data Input	-
15	LV2P	+LVDS Differential Data Input	-
16	GND	Ground	-
17	LVCLKN	-LVDS Differential Clock Input	-
18	LVCLKP	+LVDS Differential Clock Input	-
19	GND	Ground	-
20	LV3N	-LVDS Differential Data Input	-
21	LV3P	+LVDS Differential Data Input	-
22	GND	Ground	-
23	LED_GND	Ground for LED Driving	-
24	LED_GND	Ground for LED Driving	-
25	LED_GND	Ground for LED Driving	-
26	NC	No Connection	-
27	LED_PWM	PWM Input Signal for LED Driver	-

28	LED_EN	LED Enable Pin	-
29	NC	No Connection	
30	NC	No Connection	-
31	LED_VCC	Power Supply for LED Driver	-
32	LED_VCC	Power Supply for LED Driver	-
33	LED_VCC	Power Supply for LED Driver	-
34	NC	No Connection	-
35	BIST	LCD Panel Self Test Enable, When it is not used, please don't connect to GND, connecting to Normal High(3.3V) is recommended	Active Low(0V) Normal High(3.3V)
36	CSB	Serial communication enables.（For IVO use only)	-
37	SCL	Serial communication clock input.（For IVO use only)	-
38	SDA	Serial communication data input.（For IVO use only)	-
39	SCL_I2C	Serial communication clock input.（For IVO use only)	-
40	SDA_I2C	Serial communication data input.（For IVO use only)	

4.2 Signal Electrical Characteristics

4.2.1 Signal Electrical Characteristics For LVDS Receiver

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

Table 5 LVDS Receiver Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	Vth	-	-	100	mV	V_{CM}=+1.2V
Differential Input Low Threshold	Vtl	-100	-	-	mV	V_{CM}=+1.2V
Input voltage range(singled-end)	RXVIN	0.7		1.7	V	-
Magnitude Differential Input Voltage	$\|V_{ID}\|$	200	-	600	mV	-
Common Mode Voltage	V_{CM}	1	1.2	1.4	V	|VID|=0.2

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

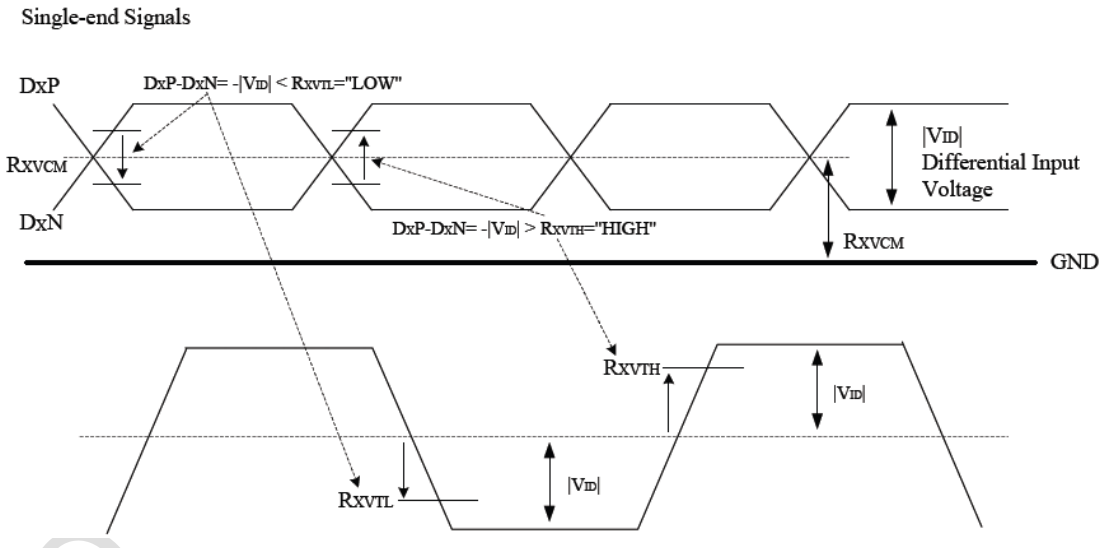
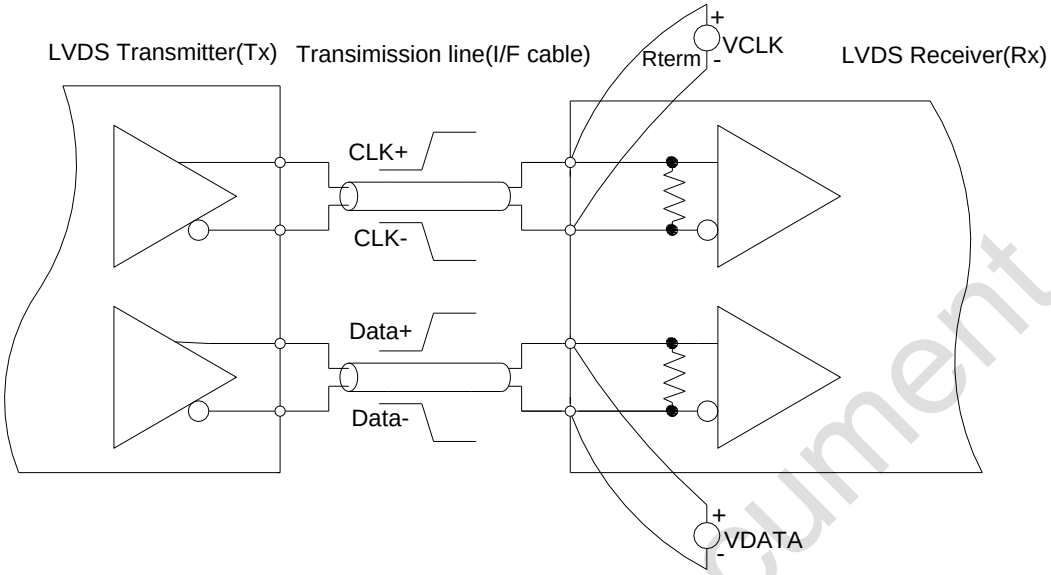


Figure 9 Measurement System



4.2.2 LVDS Receiver Internal Circuit

Figure 10 shows the internal block diagram of the LVDS receiver. This LCD module equips termination resistors for LVDS link

Figure 10 LVDS Receiver Internal Circuit

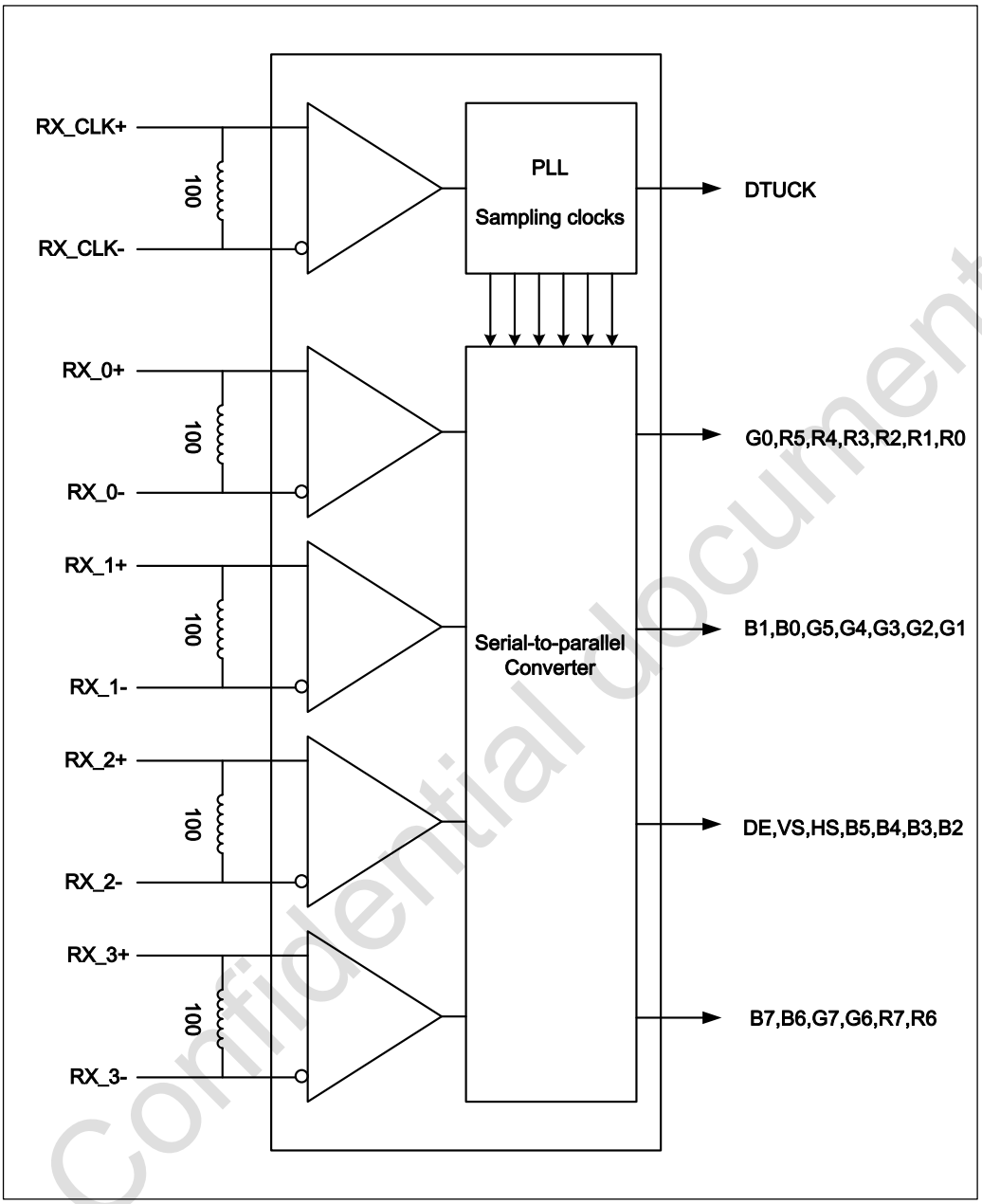
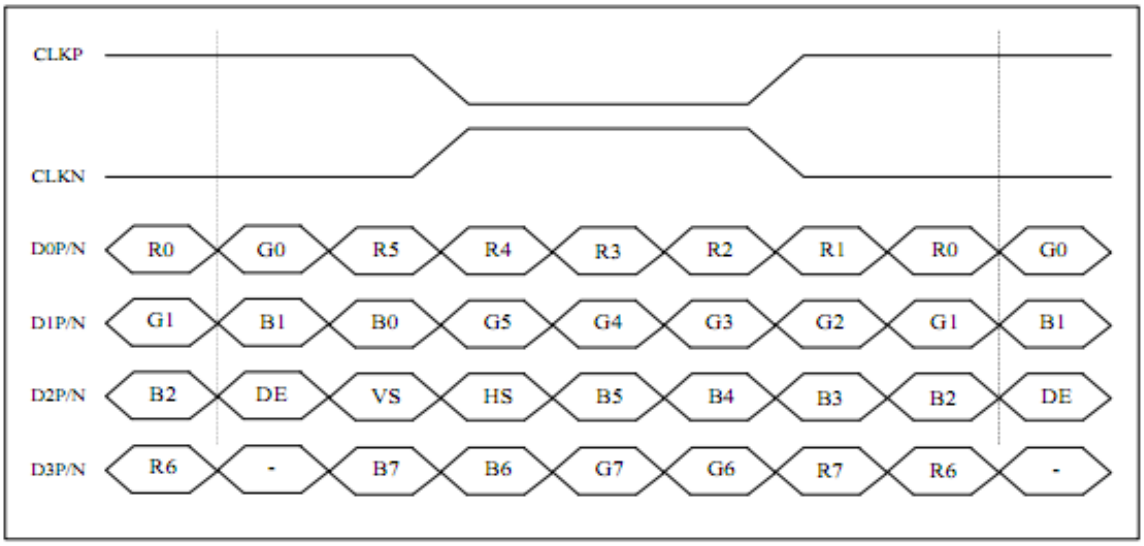


Figure 11 Data Mapping



8-bit LVDS input

4.3 Interface Timings

Table 6 Interface Timings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock Frequency	Fclk	70.0	72.4	76.6	MHz
H Total Time	HT	1,410	1,440	1,470	Clocks
H Active Time	HA		1,280		
V Total Time	VT	828	838	868	Lines
V Active Time	VA		800		
Frame Rate	FV	-	60	-	Hz

Note1：HT * VT *Frame Frequency≤76.6 MHz

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

4.4 Input Power Specification

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)		VDD	3.0	3.3	3.6	V	(1),(2),(3)
VDD Current	White pattern	I_{DD}	-	-	0.31	A	(1),(4)
VDD Power Consumption		P_{DD}	-	-	1.0	W	
Rush Current		I_{Rush}	-	-	1.5	A	(1),(5)
Allowable Logic/LCD Drive Ripple Voltage		V_{VDD-RP}	-	-	300	mV	(1)
LED Power Supply							
LED Input Voltage		V_{LED}	5	12	21	V	(1),(2)
LED Power Consumption		P_{LED}	-	-	2.5	W	(1),(6)
LED Forward Voltage		V_F	2.8	-	3.3	V	(1)
LED Forward Current		I_F	-	20	-	mA	
PWM Signal Voltage	High	V_{PWM}	3	-	3.6	V	
	Low		0	-	0.4		
LED Enable Voltage	High	V_{LED_EN}	3	-	3.6	V	
	Low		0	-	0.4		
Input PWM Frequency		F_{PWM}	100Hz	-	200Hz	Duty≥0.1%	(1),(2),(7)
			200Hz	-	500Hz	Duty≥0.25%	
			500Hz	-	1kHz	Duty≥0.5%	
			1kHz	-	2kHz	Duty≥1%	
			2kHz	-	5kHz	Duty≥2.5%	

Input PWM Frequency	F_{PWM}	5kHz	-	10kHz	Duty≥5%	(1),(2),(7)
		10kHz	-	20kHz	Duty≥10%	
		20kHz	-	30kHz	Duty≥15%	
Duty Ratio	PWM	5	-	100	%	(1),(8)
LED Life Time	LT	20,000	30,000	-	Hours	(1),(8)

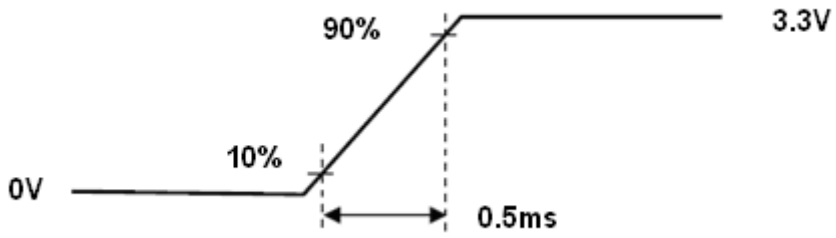
Note(1) All of the specifications are guaranteed under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 10%RH.

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 VDD current and power consumption are measured under the VDD = 3.3 V, FV = 60 Hz condition and TBD pattern.

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

Figure 12 VDD Rising Time



Note(5) The power consumption of LED Driver are under the V_{LED} = 12V, Dimming of Max luminance.

Note(6) Although acceptable range as defined, the dimming ratio is not effective at all conditions. The PWM frequency should be fixed and stable for more consistent luminance control at any specific level desired.

Note(7) The operation of LED Driver below minimum dimming ratio may cause flickering or reliability issue.

Note(8) 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. Please set timing according to the following figures, otherwise it may cause image sticking.

Figure 13 Power Sequence

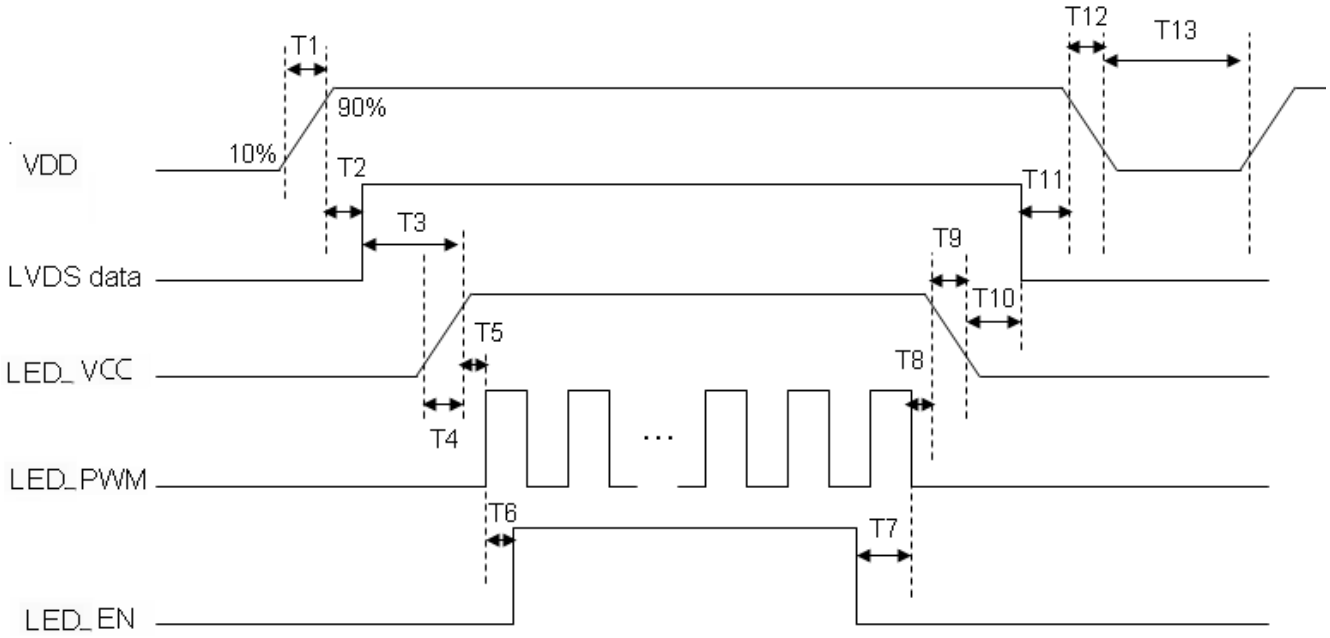


Table 8 Power Sequencing Requirements

Parameter	Symbol	Unit	min	typ	max
VDD Rise Time (10% to 90%)	T1	ms	0.5	--	10
VDD Good to Signal Valid	T2	ms	30	--	90
Signal Valid to Backlight On	T3	ms	200	--	--
Backlight Power On Time	T4	ms	0.5	--	--
Backlight LED_VCC Good to System LED_ PWM On	T5	ms	10	--	--
System LED_ PWM On to Backlight LED_ EN On	T6	ms	10	--	--
Backlight LED_ EN Off to System LED_ PWM Off	T7	ms	0	--	--
System LED_ PWM Off to B/L Power Disable	T8	ms	10	--	--
Backlight Power Off Time	T9	ms	0.5	10	30
Backlight Off to Signal Disable	T10	ms	200	--	--
Signal Disable to Power Down	T11	ms	0	--	50

VDD Fall Time	T12	ms	0.5	10	30
Power Off	T13	ms	500	--	--

5.0 Mechanical Characteristics

5.1 Outline Drawing

Figure 14 Reference Outline Drawing (Front Side)

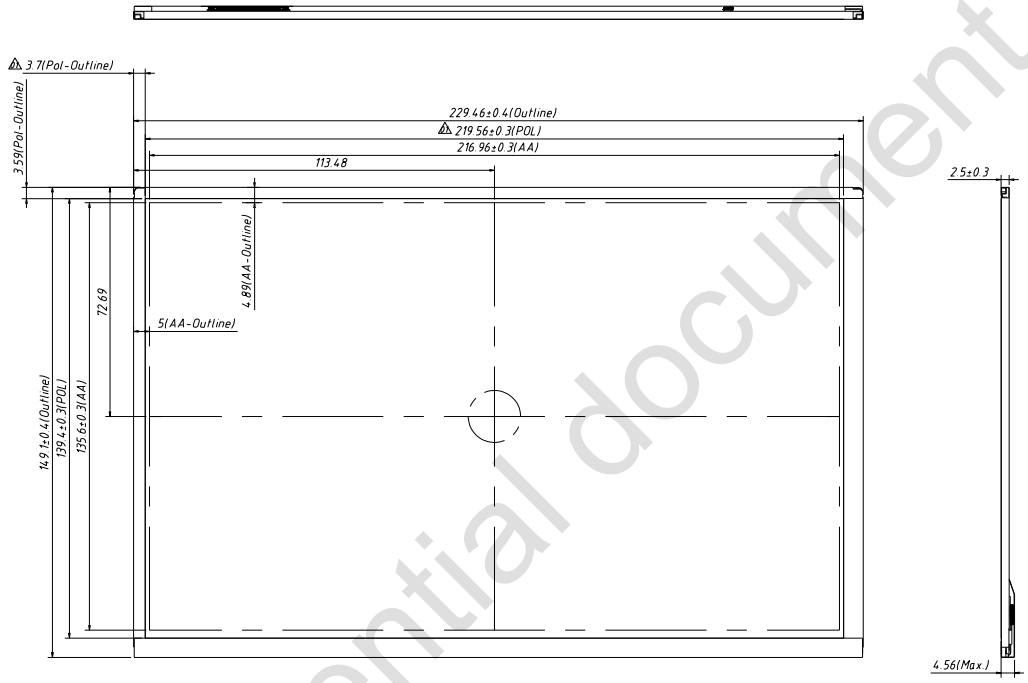
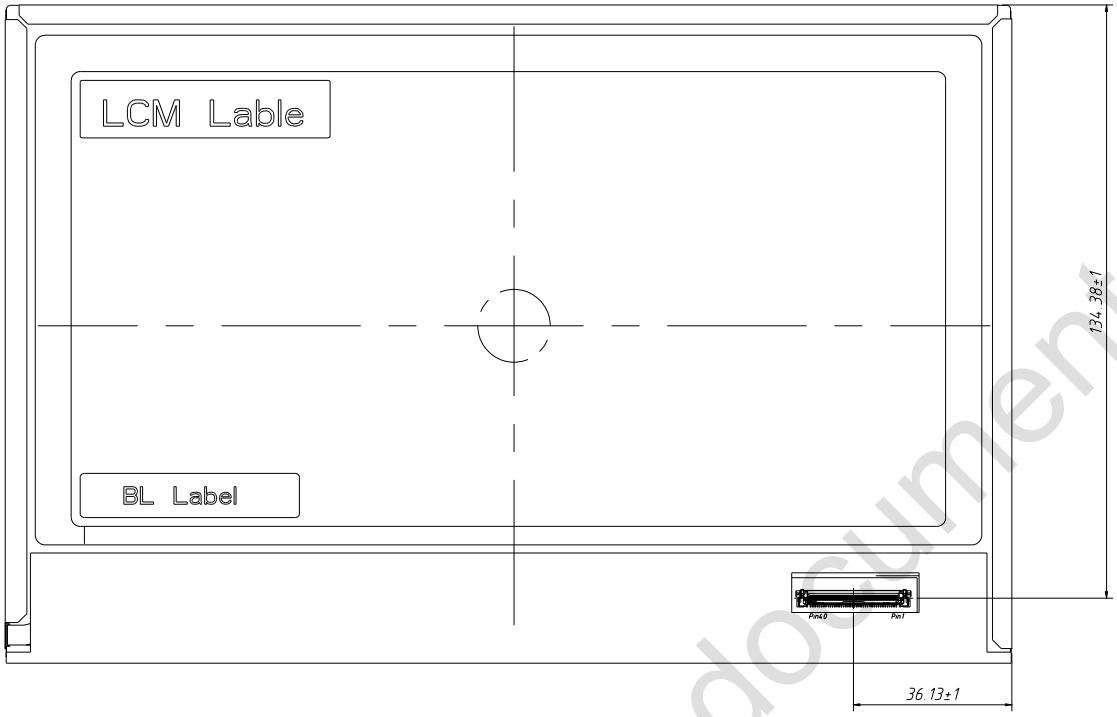


Figure 15 Reference Outline Drawing (Back Side)



Unit : mm

Note: Unnoted tolerance ±0.5mm;

5.2 Dimension Specifications

Table 9 Module Dimension Specifications

Item		Min.	Typ.	Max.	Unit
Width		229.06	229.46	229.86	mm
Height		148.7	149.1	149.5	mm
Thickness	Without PCBA	2.2	2.5	2.8	mm
	With PCBA	-	-	4.56	mm
Weight		-	-	165	g

Note：Outline dimension measure instrument： Vernier Caliper.

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, 240 hours		(1),(2),(3),(4)
High Temperature Operating Test		Module	T_{gs}=70℃, 240 hours		
Low Temperature Operating Test		Module	T_a=-20℃, 240 hours		
Low Temperature Storage Test		Module	T_a=-30℃, 240 hours		(1), (3),(4)
High Temperature Storage Test		Module	T_a=80℃， 240 hours		
Shock Non-operating Test		Module	240G, 2ms, 1time for ±x, ±y, ±z 6 directions		(1),(3),(5)
Vibration Non-operating Test		Module	1.5G , 10~500 Hz , x、y、z each axis/1hour.		
ESD Test	Operating	Module	Contact	±8KV, 150pF(330Ohm)	(1),(2),(6)
			Air	±15KV, 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.

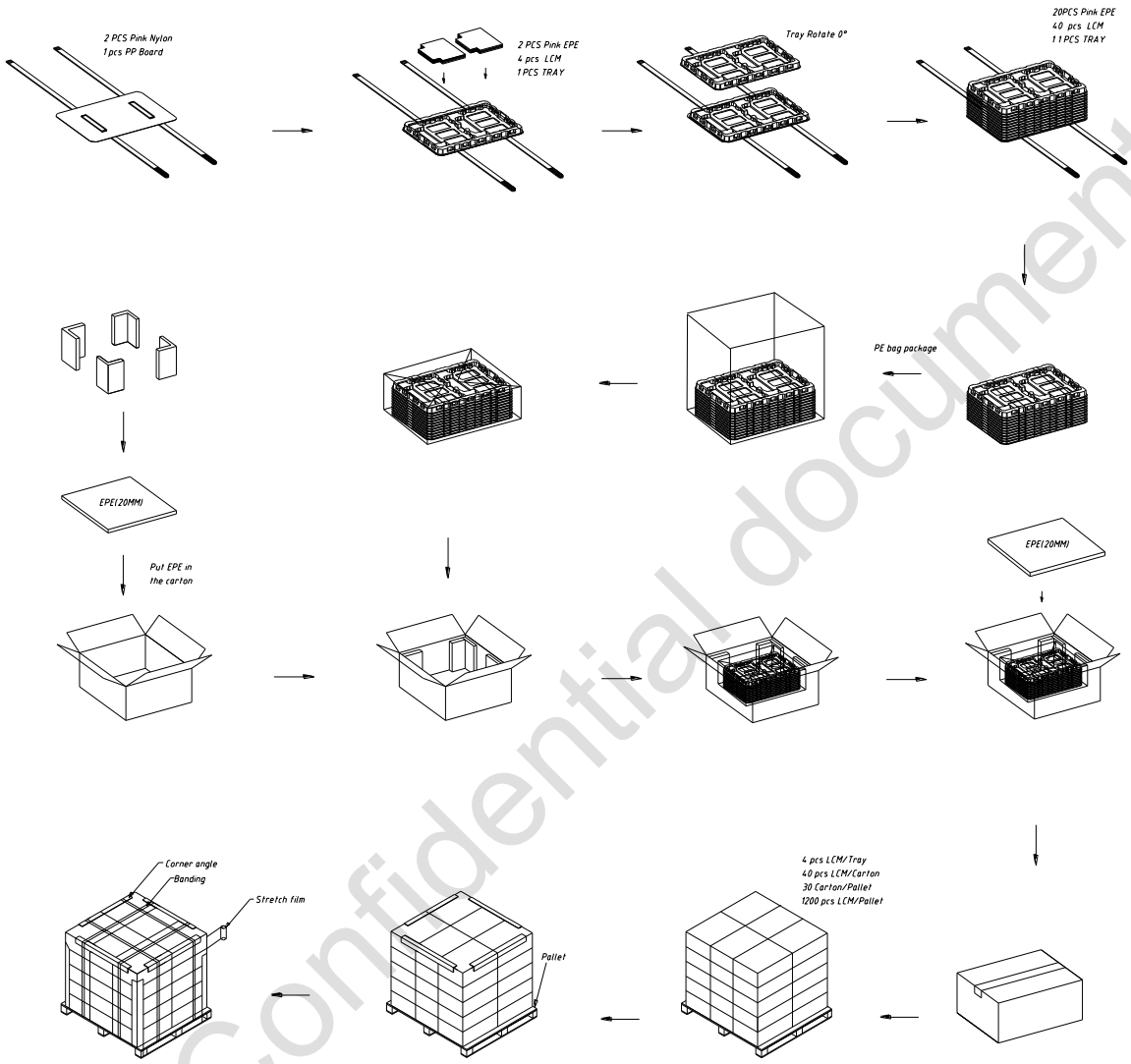
Note(4) The sample must be released for 24 hours under normal conditions before judging. Furthermore, all the judgment must be made under normal conditions. Normal conditions are defined as follow: Temperature: 25℃, Humidity: 55± 10%RH. Ta= Ambient Temperature, Tgs= Glass Surface Temperature.

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

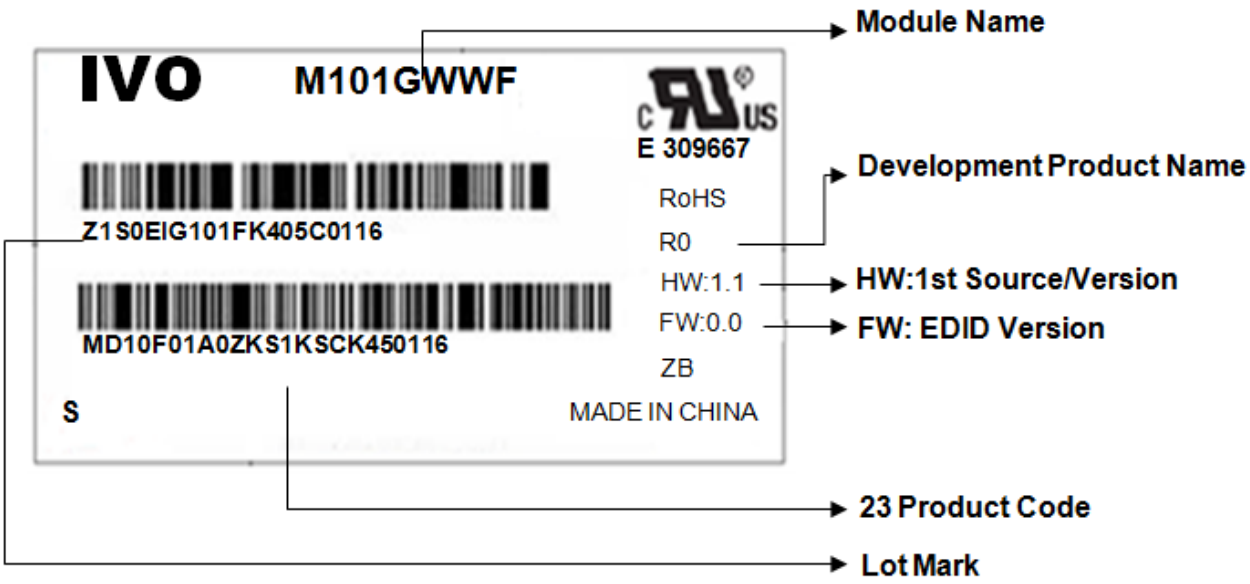
Note(6) It could be regarded as pass, when the module recovers from function fault caused by ESD after resetting.

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.

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.

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.

(10) Desirable cleaners are IPA (Isopropyl Alcohol) ,Ethyl alcohol or hexane. Do not use Ketone type materials (ex. Acetone), 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. 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.