Tentative Product Specification

To:

Product Name: M070AWPA R0

Document Issue Date: 2021/03/28

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

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Revision	Date	Page	Revised Content/Summary	Remark
00	2020/08/26	-	First issued.	
01	2020/09/15	Page10&11	Add ”MSB” in the descriptions of R7/B7/G7 Add ”LSB” in the descriptions of R0/B0/G0	
02	2021/3/28	All	Final	

CONTENTS

1.0 General Descriptions

1.1 Introduction

The M070AWPA 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 7.0 inch diagonally measured active display area with WVGA resolution (800 horizontal by 480 vertical pixels array).

1.2 Features

- Supported WVGA Resolution
- TTL Interface
- Wide View Angle
- Compatible with RoHS Standard

1.3 Product Summary

Items		Specifications	Unit
Screen Diagonal		7.0	inch
Active Area (H x V)		152.4 x 91.44	mm
Number of Pixels (H x V)		800 x 480	-
Pixel Pitch (H x V)		0.1905 x 0.1905	mm
Pixel Arrangement		R.G.B. Vertical Stripe	-
Display Mode		Normally Black	-
White Luminance		1,000 (Typ.)	cd /m^2
Contrast Ratio		1,000 (Typ.)	-
Response Time		20 (Typ.)@25℃	ms
Input Voltage		3.3 (Typ.)	V
Power Consumption		6.046 (Max.) @ White pattern, FV=60Hz	W
Weight		206 (Max.)	g
Outline Dimension (H x V x D)	Without stud	166.6(Typ.) x 105.8(Typ.) x 7.8(Max.)	mm
	With stud	166.6(Typ.) x 105.8(Typ.) x 10.8(Max.)	mm
Electrical Interface (Logic)		TTL	-
Support Color		16.7 M	-
NTSC		72 (Typ.)	%
Surface Treatment		Anti-glare,3H	-

1.4 Functional Block Diagram

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

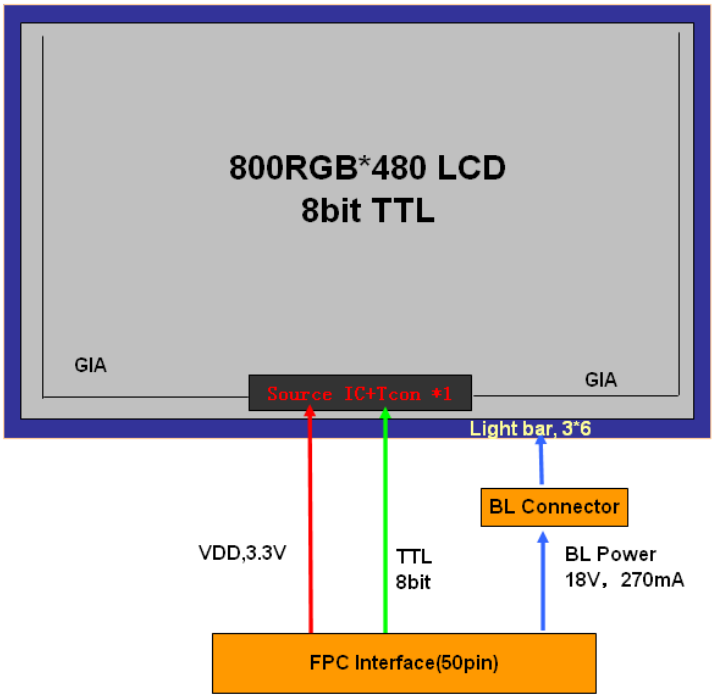


Figure 1 Block Diagram

1.5 Pixel Mapping

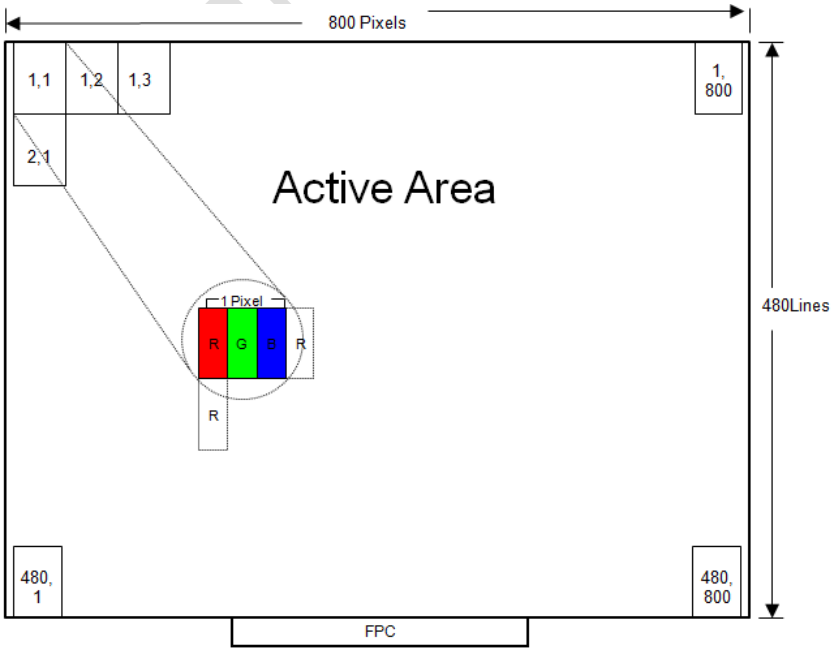


Figure 2 Pixel Mapping

2.0 Absolute Maximum Ratings

Table 1 Electrical & Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Logic Supply Voltage	VDD	-0.3	4.0	V	(1),(2), (3),(4)
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.

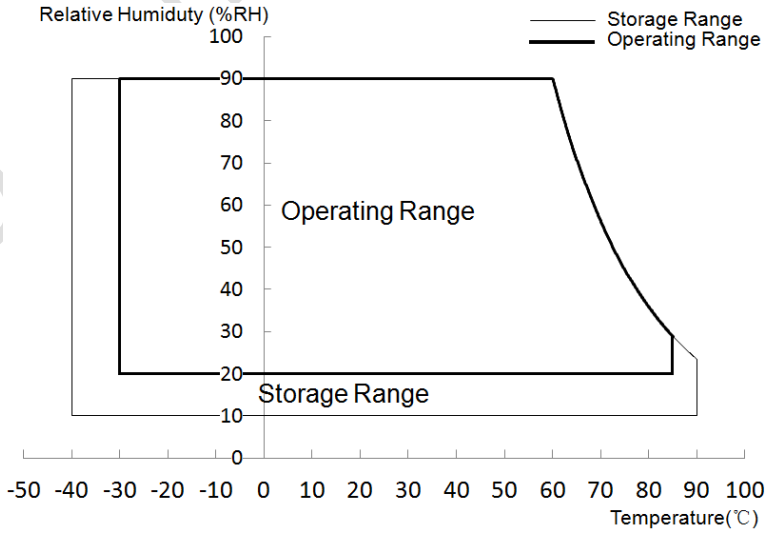


Figure 3 Absolute Ratings of Environment of the LCD Module

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+}	80	85	-	degree	(1),(2),(3), (4)(8)
		θ_{x-}	80	85	-		
	Vertical	θ_{y+}	80	85	-		
		θ_{y-}	80	85	-		
Contrast Ratio	Center		800	1,000	-	-	(1),(2),(4),(8) θx=θy=0°
Response Time (Rising + Falling)	25℃		-	20	30	ms	(1),(2),(5),(8) θx=θy=0°
	-20℃		-	200	350	ms	
	-30℃		-	370	500	ms	
Color Chromaticity (CIE1931)	Red x		Typ. (-0.04)	0.636	Typ. (+0.04)	-	(1),(2),(3),(8) θx=θy=0°
	Red y			0.330		-	
	Green x			0.310		-	
	Green y			0.630		-	
	Blue x			0.147		-	
	Blue y			0.070		-	
	White x			0.300		-	
	White y			0.320		-	
NTSC	-		68	72		%	(1),(2),(3),(8) θx=θy=0°
White Luminance	Center		800	1,000		cd/m^2	(1),(2),(6),(8) θx=θy=0°
Luminance Uniformity(9 Points)	White		80	85		%	(1),(2),(7),(8) θx=θy=0°
	Black		60	-	-		

Note (1) Measurement Setup:

The LCD module should be stabilized at given ambient temperature (25℃) for 30 minutes to avoid abrupt temperature changing during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 30 minutes in the windless room.

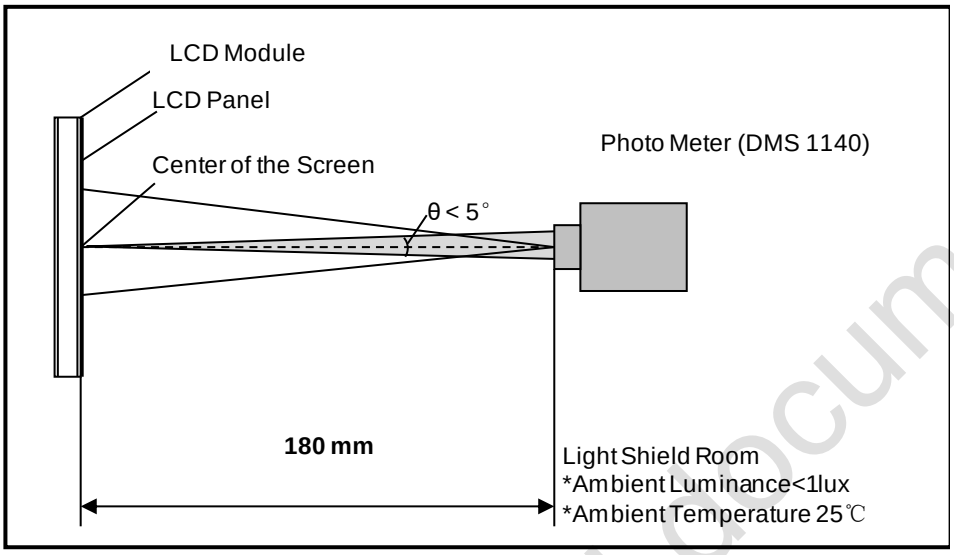


Figure 4 Measurement Setup

Note (2) The LED input parameter setting as:

I_{LED}:(270) mA

Note (3) Definition of Viewing Angle

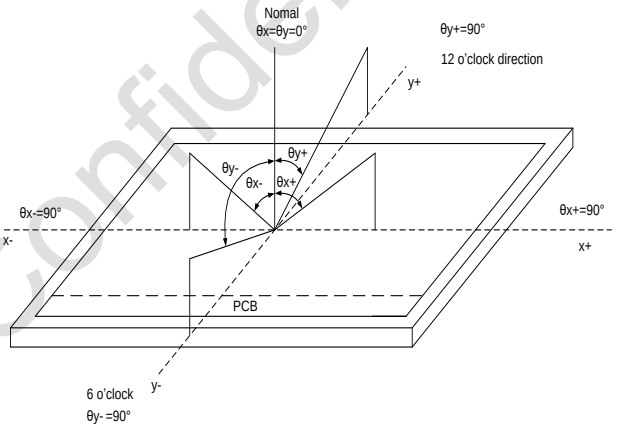


Figure 5 Definition of Viewing Angle

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)

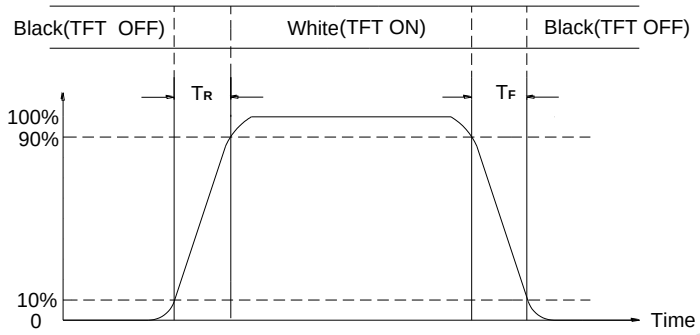


Figure 6 Definition of Response Time

Note (6) Definition of Luminance of White

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

Display Luminance=L1(center point)

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

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

Measure the luminance of White pattern at X points.

Luminance Uniformity= Min.(L1, L2, ... L9) / Max.(L1, L2, ... L9)

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

A=1/6 H， B=1/6 V

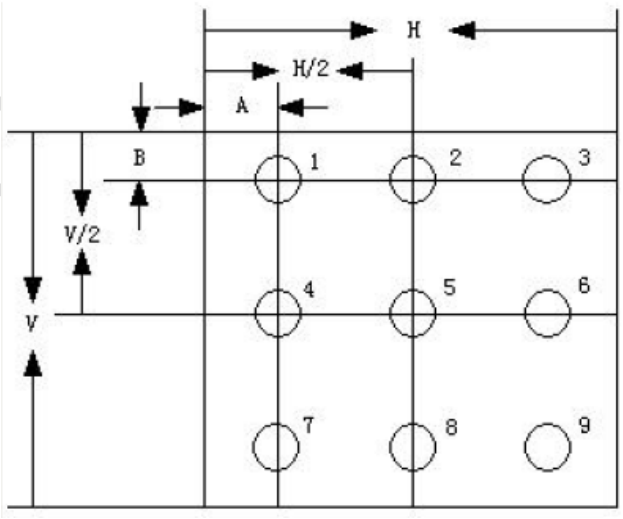


Figure 7 Measurement Locations of 9 Points

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	FH28D-50S-0.5SH(HIROSE)

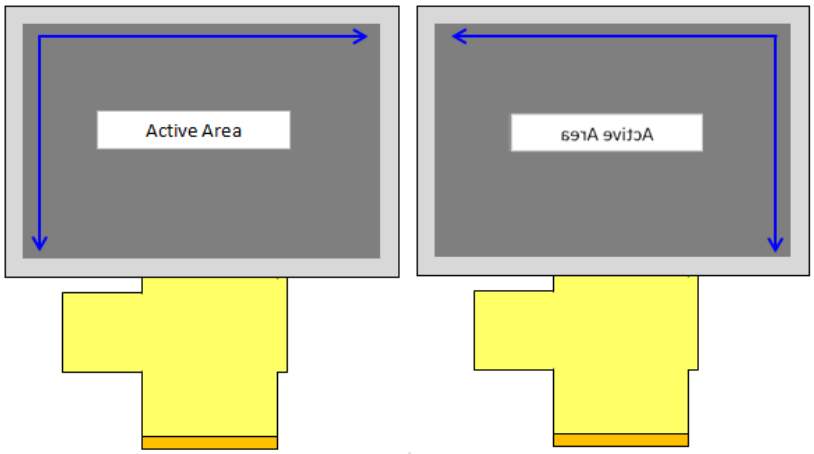
Table 4 Signal Connector Pin Assignment

Pin No.	Symbol	Description	Remarks
1	NTC1	connect to BL thermistor	-
2	LEDK1	LED Light,cathode -	-
3	LEDK2	LED Light,cathode -	-
4	LEDK3	LED Light,cathode -	-
5	NTC2	connect to BL thermistor	-
6	LEDA	Backlight anode +	18V
7	LEDA	Backlight anode +	18V
8	NC	No connection	-
9	VDD	Power supply	3.0~3.6V
10	DE	Enabled RGB Singnal pin	-
11	GND	Ground	-
12	DCLK	Clock signal for the RGB	-
13	GND	Ground	-
14	B7	Data input pins for the RGB mode(MSB)	-
15	B6	Data input pins for the RGB mode	-
16	B5	Data input pins for the RGB mode	-
17	B4	Data input pins for the RGB mode	-
18	B3	Data input pins for the RGB mode	-
19	B2	Data input pins for the RGB mode	-
20	B1	Data input pins for the RGB mode	-
21	B0	Data input pins for the RGB mode(LSB)	-
22	GND	Ground	-
23	G7	Data input pins for the RGB mode(MSB)	-
24	G6	Data input pins for the RGB mode	-
25	G5	Data input pins for the RGB mode	-
26	G4	Data input pins for the RGB mode	-
27	G3	Data input pins for the RGB mode	-

28	G2	Data input pins for the RGB mode	-
29	G1	Data input pins for the RGB mode	-
30	G0	Data input pins for the RGB mode(LSB)	-
31	GND	Ground	-
32	R7	Data input pins for the RGB mode(MSB)	-
33	R6	Data input pins for the RGB mode	-
34	R5	Data input pins for the RGB mode	-
35	R4	Data input pins for the RGB mode	-
36	R3	Data input pins for the RGB mode	-
37	R2	Data input pins for the RGB mode	-
38	R1	Data input pins for the RGB mode	-
39	R0	Data input pins for the RGB mode(LSB)	-
40	GND	Ground	-
41	STBYB	Standby mode setting pin; H: Normal mode;L:Standby Mode	-
42	LR	Horizontal shift direction(source output)selection LR=H(default),S1-S1200; LR=L,S1200-S1	(1)
43	UD	IVO Test pin, for Bist Function H：Bist Mode；L：Normal Mode	
44	RESET	Global reset pin, H:Normal Display；L:Reset active	(2)
45	GND(AG_GND)	Ground	
46	SDA	For IVO use only: The OTP mode:No connection; the initialization mode:serial interface addrerss and data input/Output for SPI interface;	For customer use, suggesting No Connection
47	SCL	For IVO use only: The OTP mode:No connection; the initialization mode:serial interface clock input for SPI interface	
48	CSB	For IVO use only: The OTP mode:No connection; the initialization mode:serial interface chip enable signal for SPI interface	

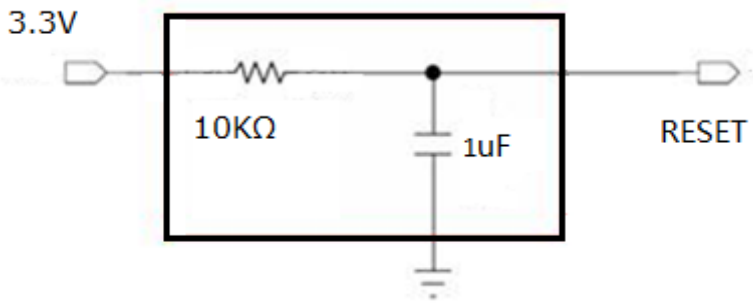
49	NC(VDDOTP)	For IVO use only: Power for OTP	
50	ATREN	For IVO use only: Enable auto reload OTP /EEPROM every 60frames Active H:enable auto reload OTP/EEPROM Active L:disable auto reload OTP/EEPROM	

Note (1) H：3.0V；L： 0.5V；



Normal Scan (H) Reverse Scan (L)

Note (2) The system side should add a RC circuit on the 44th pin as below



4.2 Power Voltage Specification

Table 5 Power Voltage

Item	Symbol	Min.	Typ.	Max.	Units	Note
Input High Level	VIH	VDDX0.7	-	VDD+0.3	V	3.0<VDD<3.6
Input low voltage	VIL	0	-	VDDX0.3	V	3.0<VDD<3.6
Output High Level	VOH	VDD-0.4	-	-	V	-
Output low voltage	VOL	0	-	VDD+0.4	V	-

Note (1) Operating temperature 25℃, humidity 55%RH.

4.3 Interface Timings

4.3.1 Timing Characteristics

Synchronization method should be DE mode.

Table 6 Interface Timings

Parameter	Symbol	Unit	Min.	Typ.	Max.
DCLK	fdck	MHz	-	27.21	-
H Total Time	Th	clocks	855	872	1,200
H Active Time	HA	clocks		800	
V Total Time	Tv	lines	492	520	750
V Active Time	VA	Lines		480	
V Frequency	fv	Hz	55	60	65

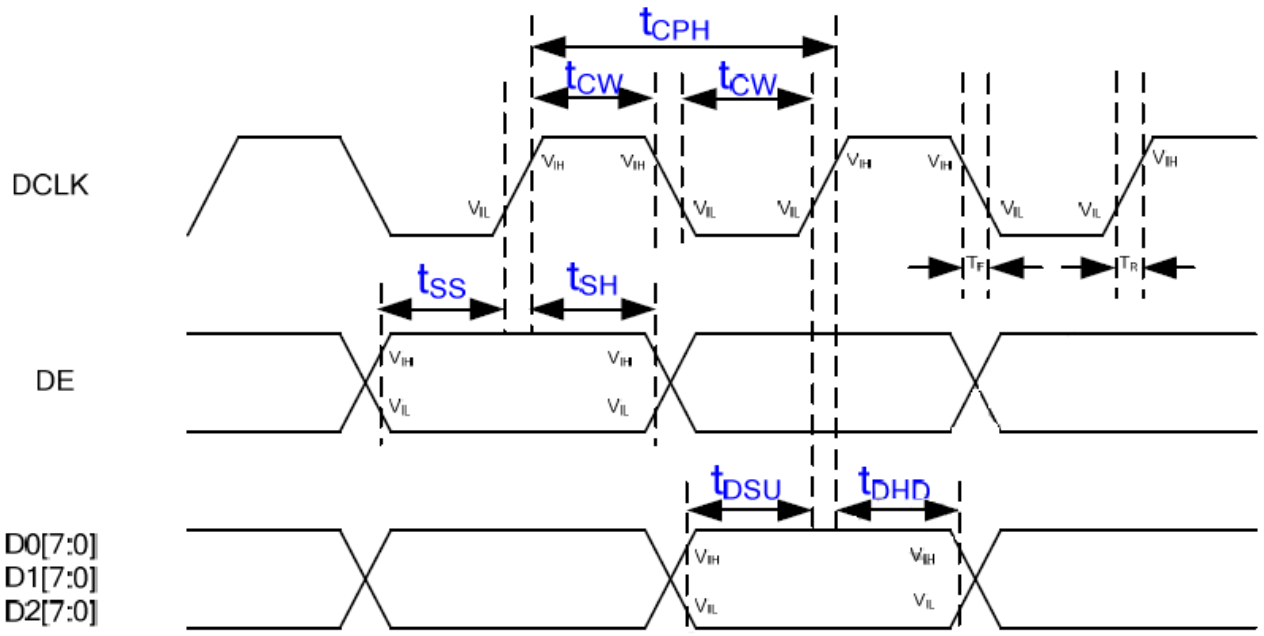


Figure 8 Timing Characteristics

4.3.2 Input setup timing requirement

Parameter	Symbol	Unit	Min.	Typ.	Max.
DCLK period	Tcph	ns	16.67	-	-
DCLK clock high/low width	Tcw	ns	6	-	-
Data setup time	TDSU	ns	5	-	-
Data hold time	TDSD	ns	5	-	-
DE setup time	Tss	ns	5	-	-
DE hold time	Tsh	ns	5	-	-
Input signal rising time	TB	ns	-	-	10
Input signal falling time	TF	ns	-	-	10

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}	-	-	0.21	A	(1),(3)
VDD Power Consumption	White Pattern	P_{DD}	-	-	0.7	W	
Horizontal Reverse Scan	High level voltage	V_{SCAN}	3.3		3.6	V	(1)
	Low level voltage		0		0.5	V	
Rush Current		I_{Rush}	-	-	1	A	(1),(4)
Allowable Logic/LCD Drive Ripple Voltage		V_{VDD-RP}	-	-	200	mV	(1),(3)
LED Power Supply							
LED Input Voltage		V_{LED}	16.2	18	19.8	V	(1),(2),(6)
LED Power Consumption		P_{LED}	-	4.86	5.346	W	(1),(5),(6)
LED Forward Voltage		V_F	2.7	3.0	3.3	V	(1),(2),(7),(8)
LED Forward Current		I_F	-	90	-	mA	
LED Life Time		LT	30,000	-	-	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.

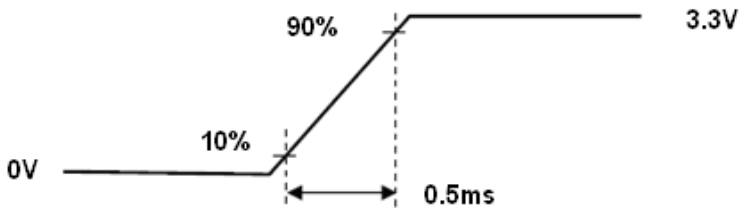
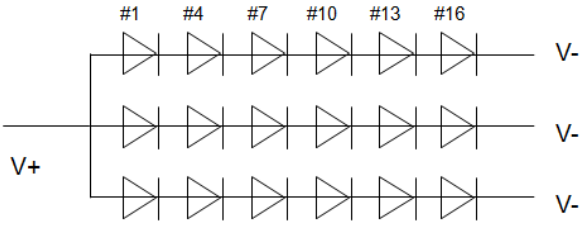


Figure 9 V_{DD} Rising Time

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.

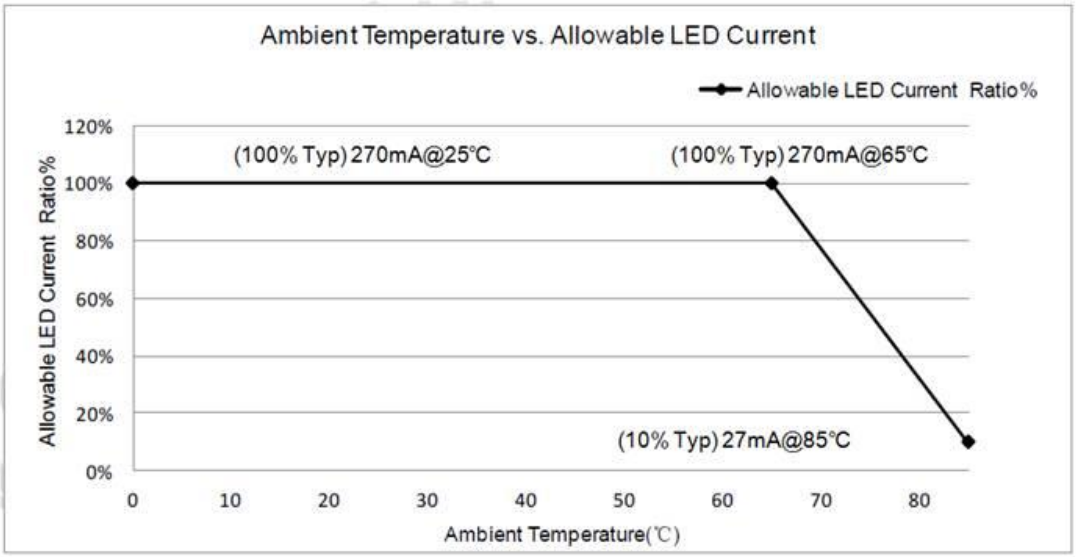
Note (6) Definition of VLED and PLED

V_{LED} =V_F×6, I_{LED} =I_F×3, PLED = V_{LED}×I_{LED}



Note (7) The circuit diagram of thermistor as below

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



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.

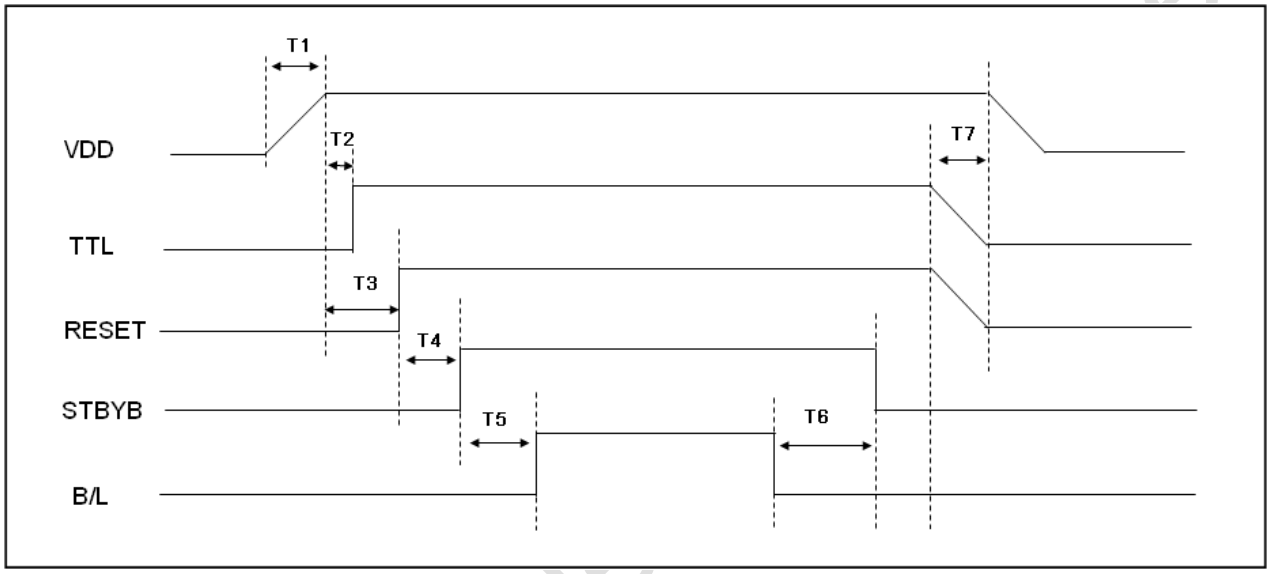


Figure 10 Power Sequence

Table 8 Power Sequencing Requirements

Parameter	Symbol	Min.	Typ.	Max.	Unit
VDD Rise Time	T1	0	-	10	ms
VCC Good to Signal Valid	T2	0	-	50	ms
VCC Good to RESET signal active	T3	10	-	-	ms
RESET active to STBYB active	T4	20	-	-	ms
STBYB active to B/L ON	T5	200	-	-	ms
B/L OFF to signal OFF	T6	200	-	-	ms
All signal OFF to VDD Fall	T7	0	-	-	ms

5.0 Mechanical Characteristics

5.1 Outline Drawing

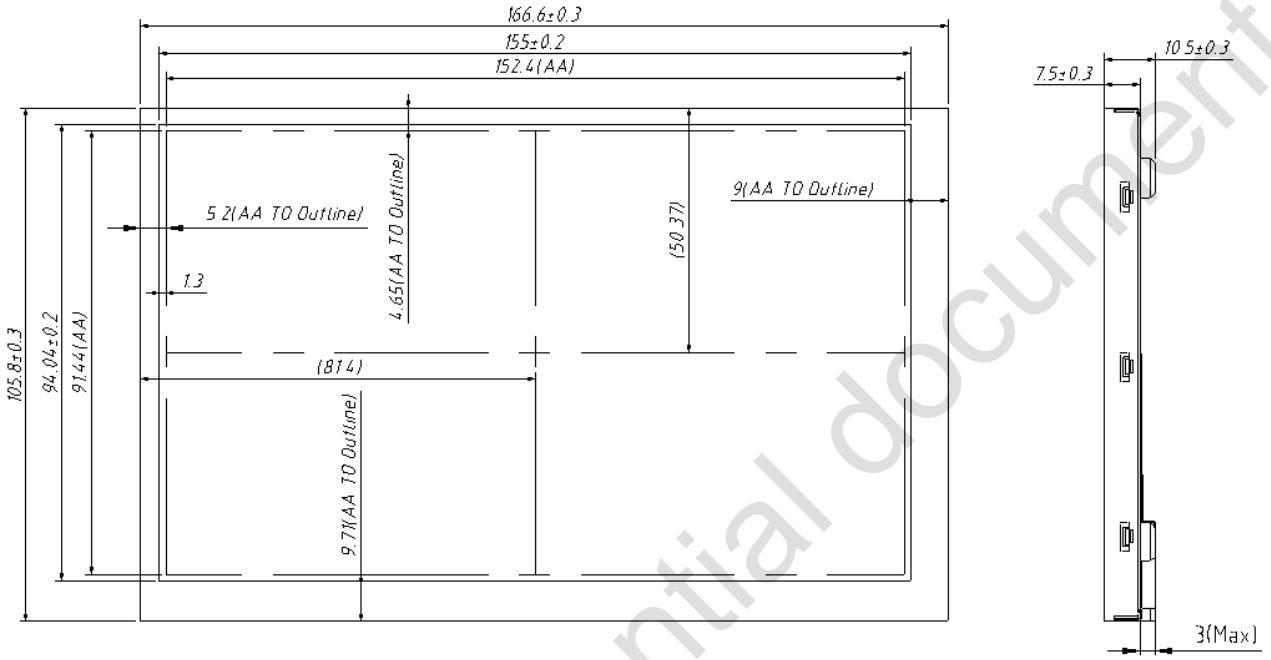
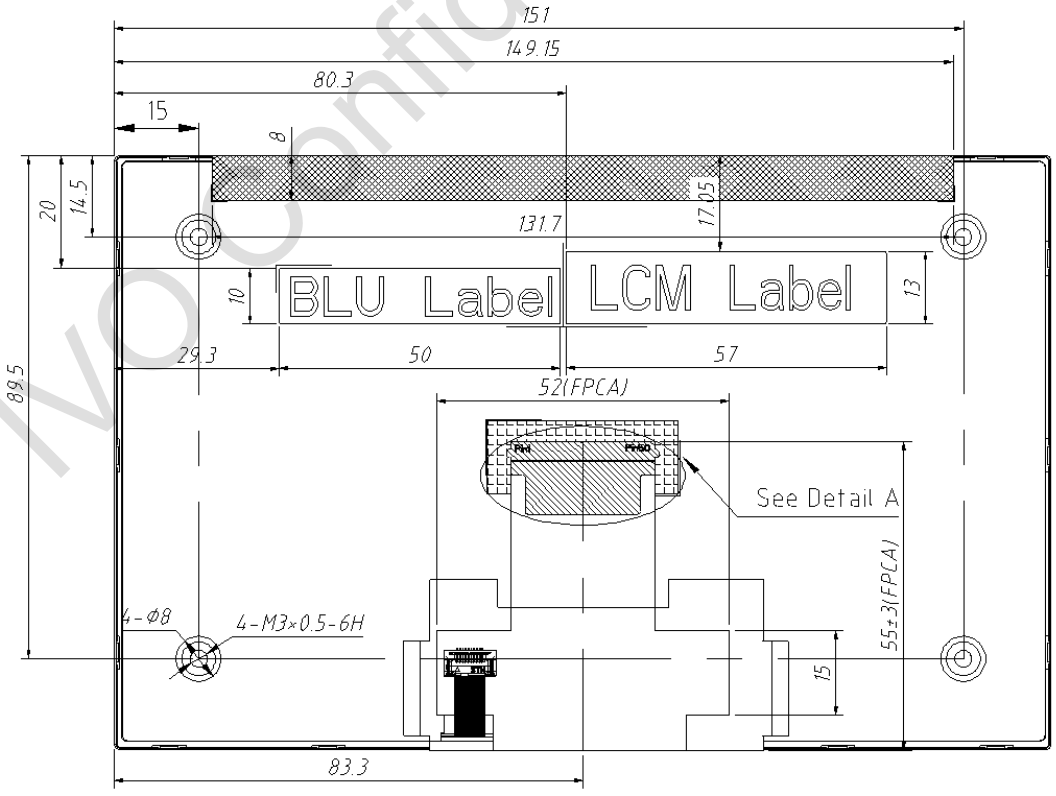
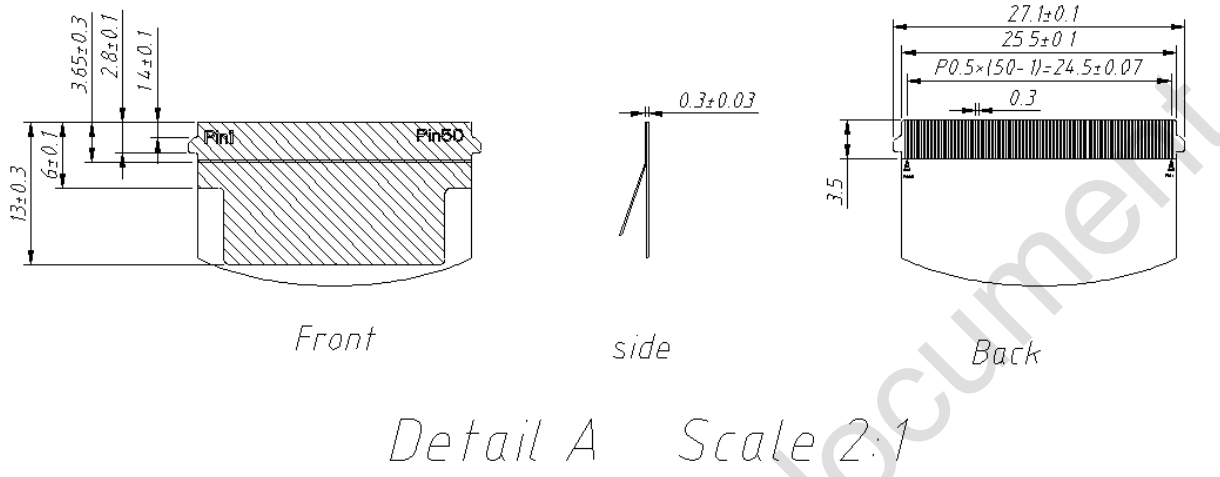


Figure 11 Reference Outline Drawing (Front Side)





Unmarked tolerance is ±0.5mm

Figure 12 Reference Outline Drawing (Back Side)

5.2 Dimension Specifications

Table 9 Module Dimension Specifications

Item		Min.	Typ.	Max.	Unit
Width		166.3	166.6	166.9	mm
Height		105.3	105.8	106.1	mm
Thickness	Without stud	7.2	7.5	7.8	mm
	With stud	-	10.5	10.8	mm
Weight		-	187	206	g
BM: | a-b | & | c-d |		-	-	≤1.0	mm

Note：Outline dimension measure instrument: Vernier Caliper.

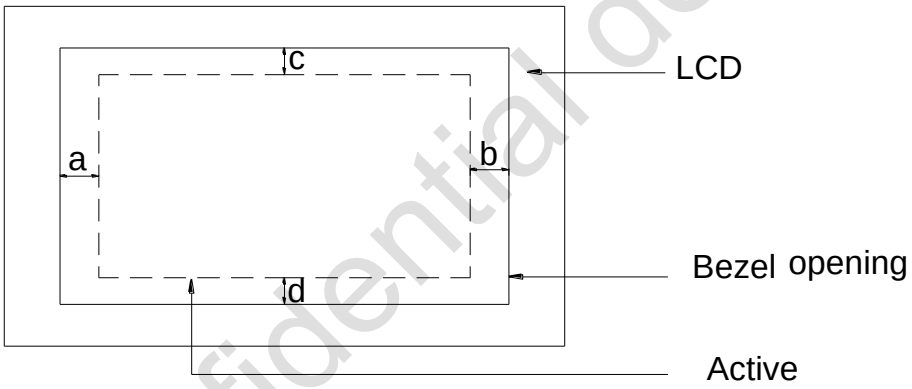


Figure 13 BM Area

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),(7)
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	980m/s 2.6ms，±X，±Y，±Z 3times for each direction		(1),(3),(5)
Vibration Non-operating Test		Module	Amplitud 1.5mm，10~55~10 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. 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) LED forward current should follow the current of LED vary with environmental temperature.

7.0 Package Specification

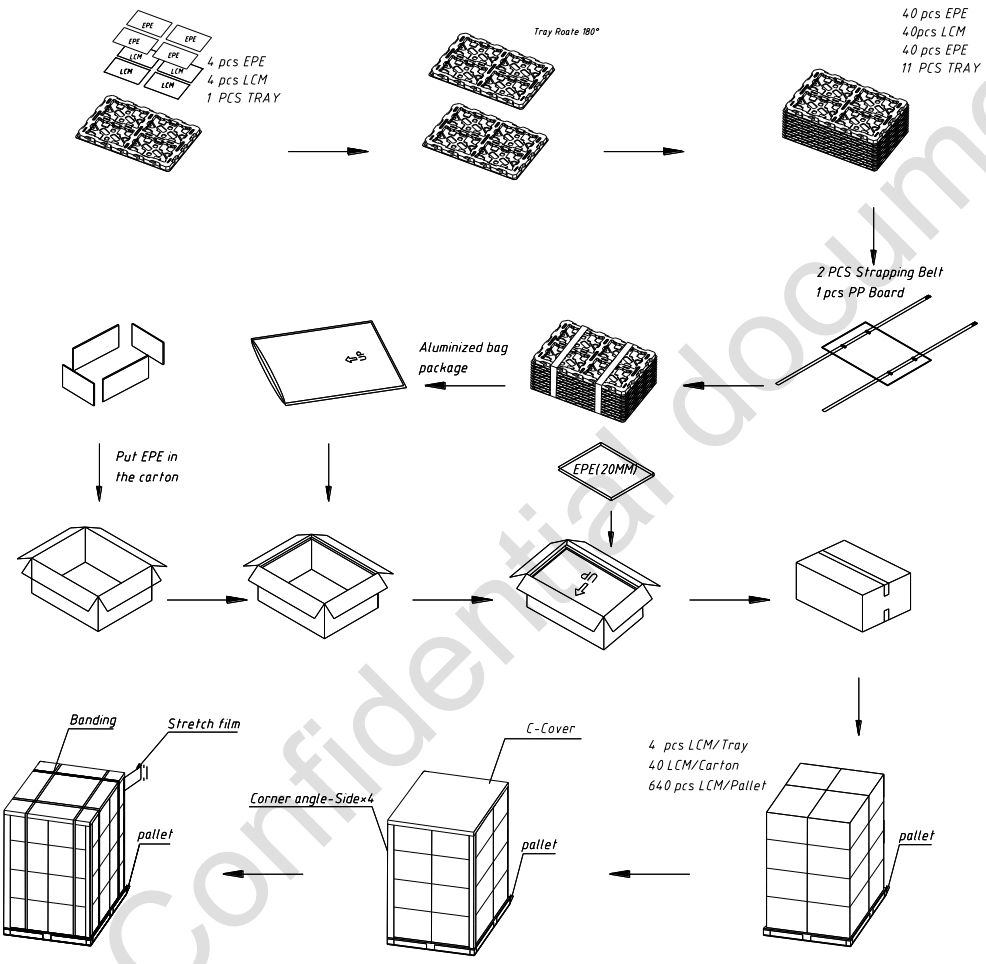
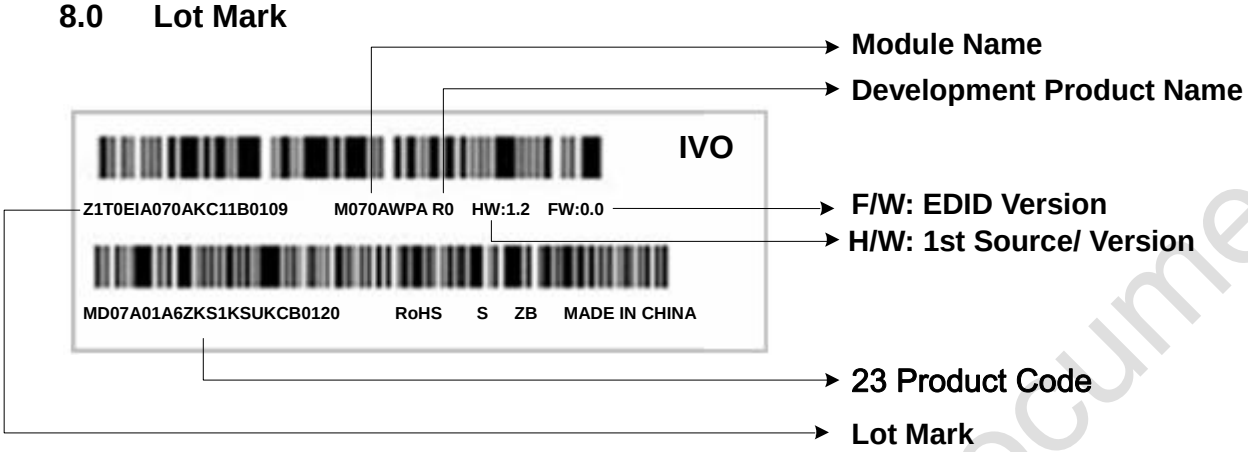


Figure 14 Packing Method

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) 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)Clean the panel gently with absorbent cotton or soft cloth when it is dirty. Ethanol(C_2H_5OH) is allowed to be used. Ketone (ex. Acetone), Toluene, Ethyl acid, Methyl chloride, etc are not allowed to be used for cleaning the panel, which might react with the polarizer to cause permanent damage.
(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.