深圳市勋瑞光电科技有限公司
Xunrui Shenzhen Optoelectronics Technology Co., Ltd.

Customer : _____

Model Name: _____H090KWS60I4010_____

1010900098 _____

Spec Vision: _____V.1_____

Date: _____2022-8-22_____

■ **Preliminary Specification**

☐ **Final Specification**

Approved by	Comment

Prepared by	Reviewed by	Approved by

Record of Revision

Version	Revise Date	Page	Content	Modified by
V.1	2022-8-22	-	First Issued	

Contents

1. General Specifications

this color active matrix thin film transistor (TFT)   liquid crystal di splay (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, Driver IC, FPC and Backlight.

1.1 LCD Characteristics

NO.	Item	Specification	Remark
1	Panel Size	9.0 inch(Diagonal)	
2	Resolution	1024 x 3(RGB) x 600	
3	Driver Method	A-Si TFT active matrix	
4	Active Area	196.608(H) x 114.15(V)	mm
5	Dot Pitch	0.192(H) x 0.19025(V)	mm
6	Pixel Arrangement	RGB-stripe	
7	Module Size	210.7(W) x 126.5(H) x5.0(D)	mm
8	Display Mode	Normally Black	
9	Display Color	16.7M	
10	Viewing Direction	ALL	
11	Interface	LVDS	
12	Driving IC	HX8282+HX8696	
13	Luminance	400(TYP)	cd/m^2
14	Weight	TBD	g

2. Pin Assignment

No.	Symbol	Function	Remarks
1	GND	Power ground	
2	AVDD	Analog Power	
3	VDD	Power for analog circuit	
4	GND	Power ground	
5	VCOM	Common Voltage	
6	VDD	Power for analog circuit	
7	GND	Power ground	
8-14	NC	No connection	
15	GND	Power ground	
16	VDD	Power for analog circuit.	
17	GND	Power ground	
18	PIND3	Positive LVDS differential Data inputs	
19	NIND3	Negative LVDS differential Data inputs	
20	GND	Power ground	
21	PINC	Positive LVDS differential clock inputs	
22	NINC	Negative LVDS differential clock inputs	
23	GND	Power ground	
24	PIND2	Positive LVDS differential Data inputs	
25	NIND2	Negative LVDS differential Data inputs	
26	GND	Power ground	
27	PIND1	Positive LVDS differential Data inputs	
28	NIND1	Negative LVDS differential Data inputs	
29	GND	Power ground	
30	PIND0	Positive LVDS differential Data inputs	
31	NIND0	Negative LVDS differential Data inputs	
32	GND	Power ground	
33	GND	Power ground	

34	RESET	Common Voltage	
35	STBYB	Standby mode ,normally pull high	
36	SHLR	Left / right display control	
37	VDD	Power for analog circuit	
38	UPND	Up/Down display control	
39	GND	Power ground	
40	AVDD	Analog Power	
41	VCOM	Common Voltage	
42	DITH	Dithering function enable control	
43	GND	Power ground	
44	VDD	Power for analog circuit	
45	GND	Power ground	
46-52	NC	No connection	
53	GND	Power ground	
54	VDD	Power for analog circuit	
55	SELB	6 bit/8 bit mode select H:6bit /L 8bit	
56	VGH	Gate on Voltage	
57	VDD	Power for analog circuit	
58	VGL	Gate off Voltage	
59	GND	Power ground	
60	BIST	Normal Operation/BIST pattern select.Normally pull low. When BIST=H:BIST(CLK input is not needed.). When BIST=L:Normal Operation(Default).	

3. Operation Specifications

3.1. Absolute Maximum Ratings

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power Voltage	VDD	-0.3	5.0	V	
	AVDD	-0.5	15.0	V	
	V_{GH}	-0.3	40	V	
	V_{GL}	-20.0	0.3	V	
	V_{GH}-V_{GL}	12	40.0	V	

Note: The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings case ,the module may be permanently destroyed.

3.1.1. Typical Operation Range

Item	Symbol	values			Unit
		Min.	Typ.	Max.	
Power Voltage	VDD	3.0	3.3	3.6	V
	AVDD	11.4	11.6	11.8	V
	VGH	16.5	17	17.5	V
	VGL	-7.5	-7	-6.5	V
Input signal voltage	VCOM	4.6	4.8	5.0	V
Input logic high voltage	V_{IH}	0.7 V_{DD}	-	V_{DD}	V
Input logic low voltage	V_{IL}	0	-	0.3 V_{DD}	V

3.1.2. Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I_{GH}	-	0.5	1.5	mA	VGH=20V
	I_{GL}	-	1	1.5	mA	VGL=-7V
	I_{VDD}	-	15	25	mA	VDD=3.3V
	I_{AVDD}	-	20	50	mA	AVDD=11.6V

3.1.3. Backlight Driving Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage of white LED backlight	V_L	16.2	18	19.2	V
Current for LED backlight	I_L	-	120	-	mA
Power dissipation	Pd	-	2160	-	mW
Luminance (on the module surface ,BM-7)		350	400	-	cd/m^2
LED life time	-	30000	-	-	Hr

PIN(K) PIN(A)
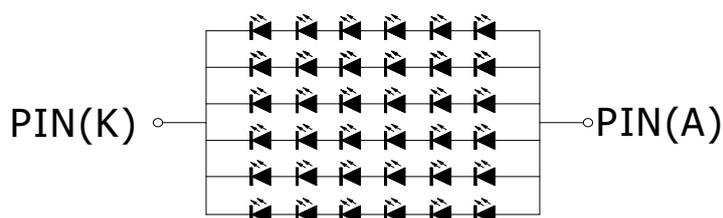
LED CIRCUIT DIAGRAM:
6S6P=36LED
VF=16.2-19.2V; IF=120mA

3.2. Power Sequence
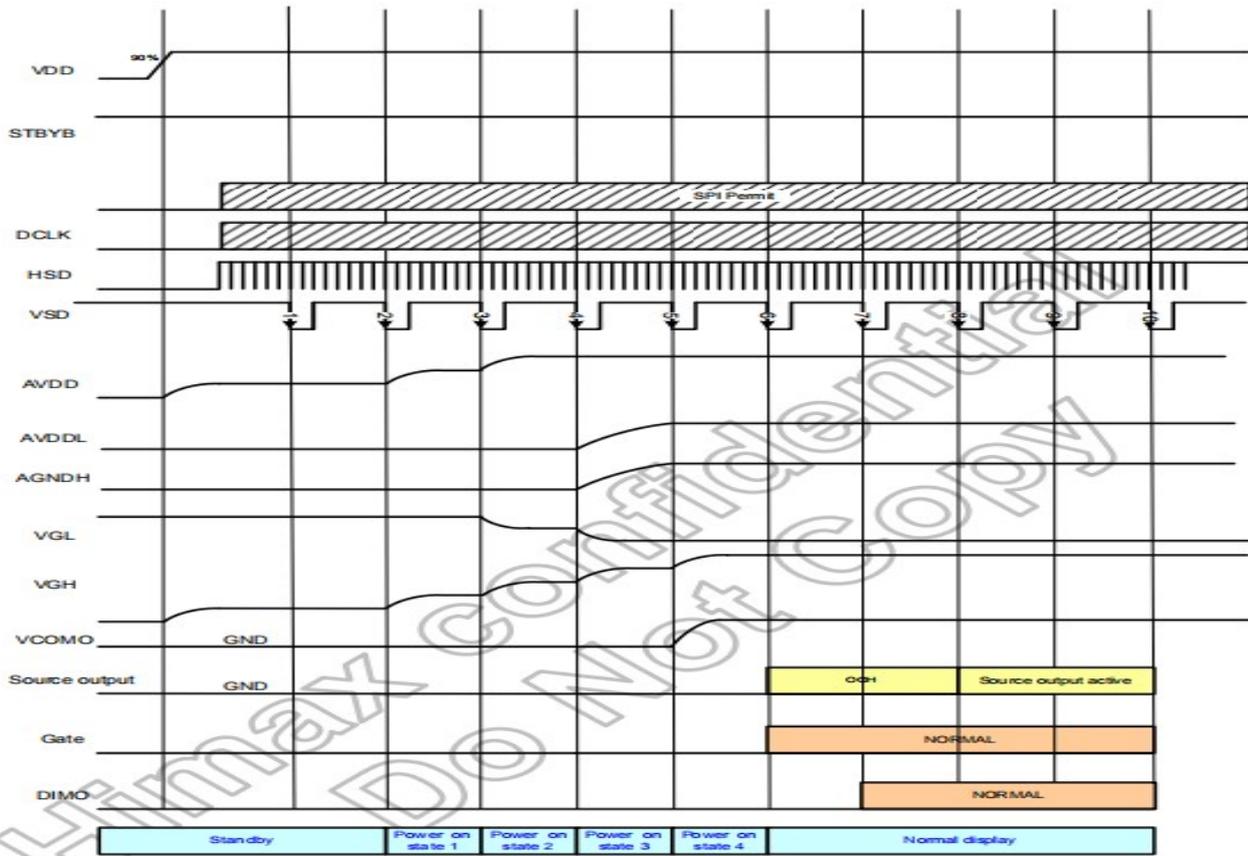
Figure 8.1: Power on timing sequence
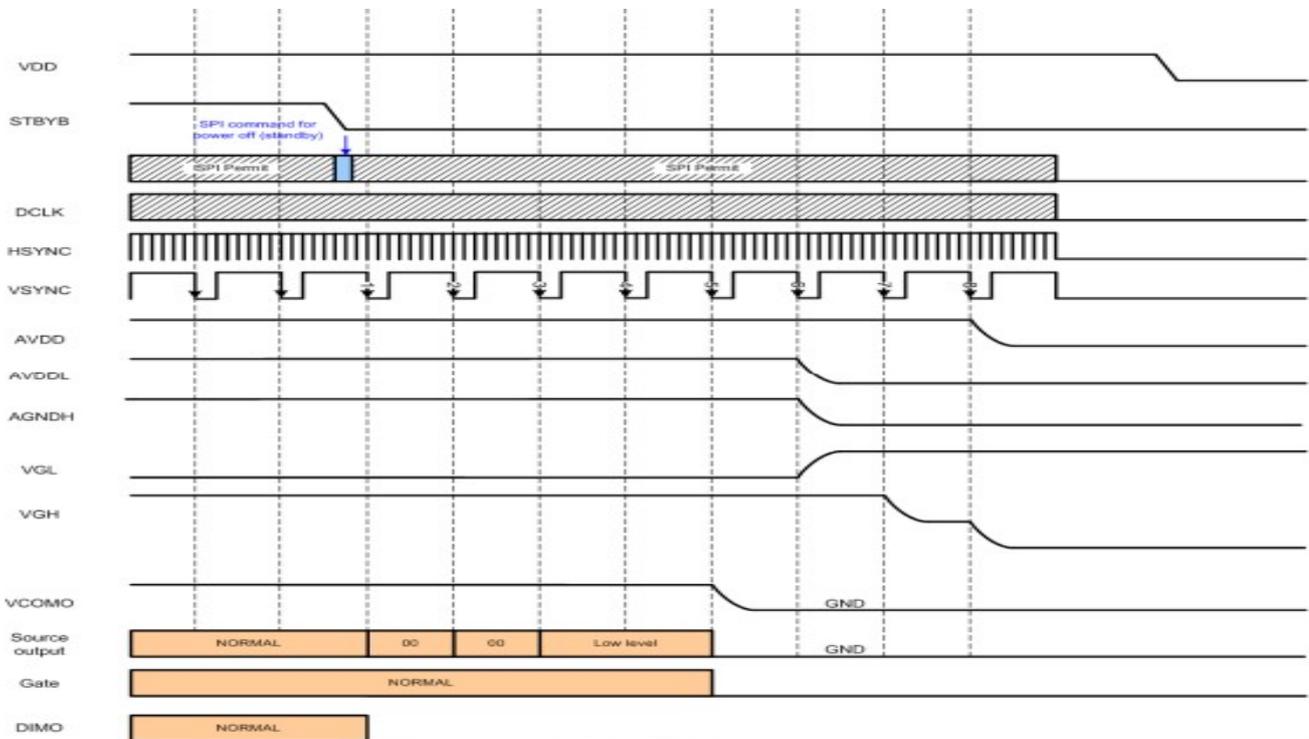
Note: (1) Low level=3FH, when NBW=L. (Normally white)
(2) Low level=00H, when NBW=H. (Normally black)

Figure 8.2: Power off timing sequence

3.3. Timing Characteristics

3.3.1. DC Electrical Characteristics

Parameter	Symbol	Condition	Spec. Min.	Spec. Typ.	Spec. Max.	Unit
Differential input high Threshold voltage	R_{XVTH}	R_{XVCM}=1.2V	-	-	+0.1	V
Differential input low threshold voltage	R_{XVTL}		-0.1	-	-	V
Input voltage range (Singled-end)	R_{XVIN}	-	0	-	VDD-1.2+ $\|V_{ID}\|$/2	V
Differential input common mode voltage	R_{XVCM}	-	$\|V_{ID}\|$/2	-	VDD-1.2	V
Differential input voltage	$\|V_{ID}\|$	-	0.2	-	0.6	V
Differential input leakage Current	RV_{Xliz}	-	-10	-	+10	µA
LVDS digital operating Current	Iddlvds	Fclk=65MHz, VDD=3.3V	-	15	30	mA
LVDS digital stand-by Current	Istlvds	Clock & all functions are stopped	-	10	50	µA

Table 9.3: LVDS mode DC electrical characteristics
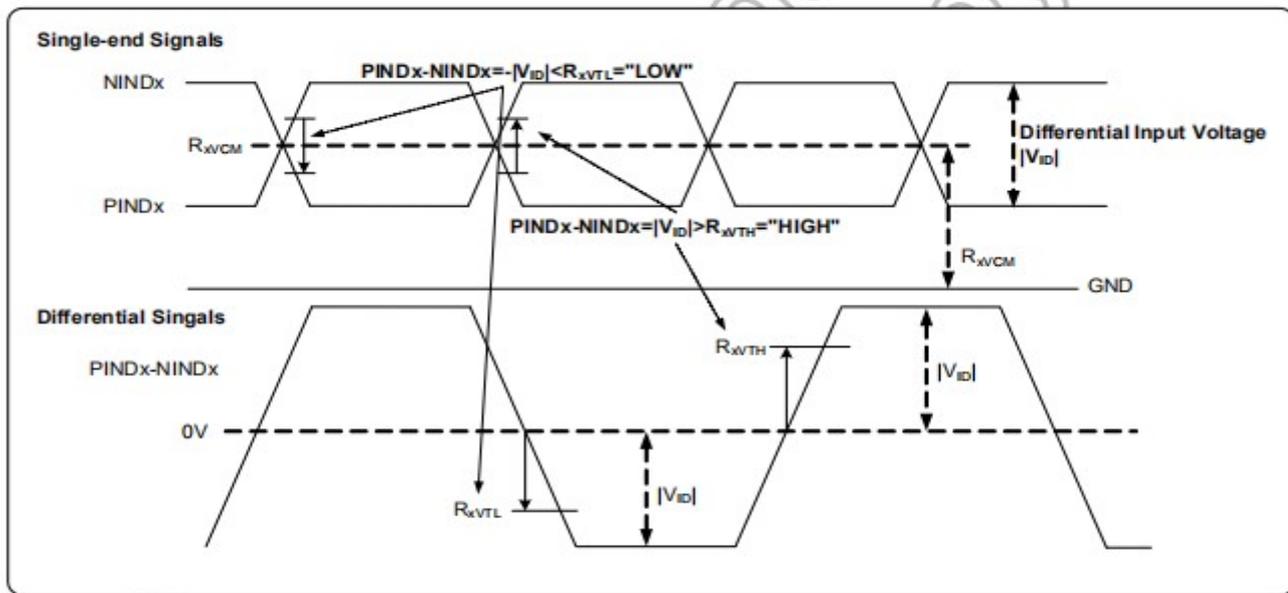
Figure 9.1: Single-end signals

3.3.2. AC Electrical Characteristics

Parameter	Symbol	Condition	Spec. Min.	Spec. Typ.	Spec. Max.	Unit
Clock frequency	R_{XFCLK}	-	20	-	71	MHz
Input data skew margin	T_{RSKM}	$\|V_{ID}\|$=400mV R_{XVCM}=1.2V R_{XFCLK}=71MHz	500	-	-	pS
Clock high time	T_{LVCH}	-	-	4/(7xR_{XFCLK})	-	ns
Clock low time	T_{LVCL}	-	-	3/(7xR_{XFCLK})	-	ns
PLL wake-up time	T_{enPLL}	-	-	-	150	µs

Table 10.2: LVDS mode AC electrical characteristics

3.3.3. Timing

● **Horizontal timing**

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK frequency	fclk	44.9	51.2	63	MHz
Horizontal display area	thd		1024		DCLK
HSD period	th	1200	1344	1400	DCLK
HSD pulse Width	thpw	1	-	140	DCLK
HSD back porch	thbp		160		DCLK
HSD front porch	thfp	16	160	216	DCLK

Table 10.5: HV mode horizontal timing (1024x600)

● **Vertical timing**

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical display area	tvd		600		T_H
VSD period	tv	624	635	750	T_H
VSD pulse width	tvpw	1	-	20	T_H
VSD back porch	tvbp		23		T_H
VSD front porch	tvfp	1	12	127	T_H

Table 10.6: HV mode vertical timing (1024x600)

3.3.4. Date Input Format
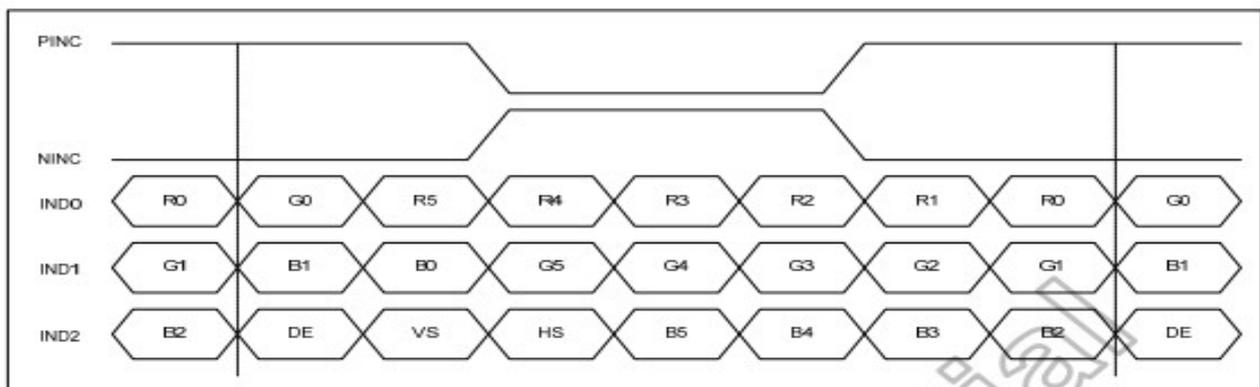
Figure 10.4: 6-bit LVDS input
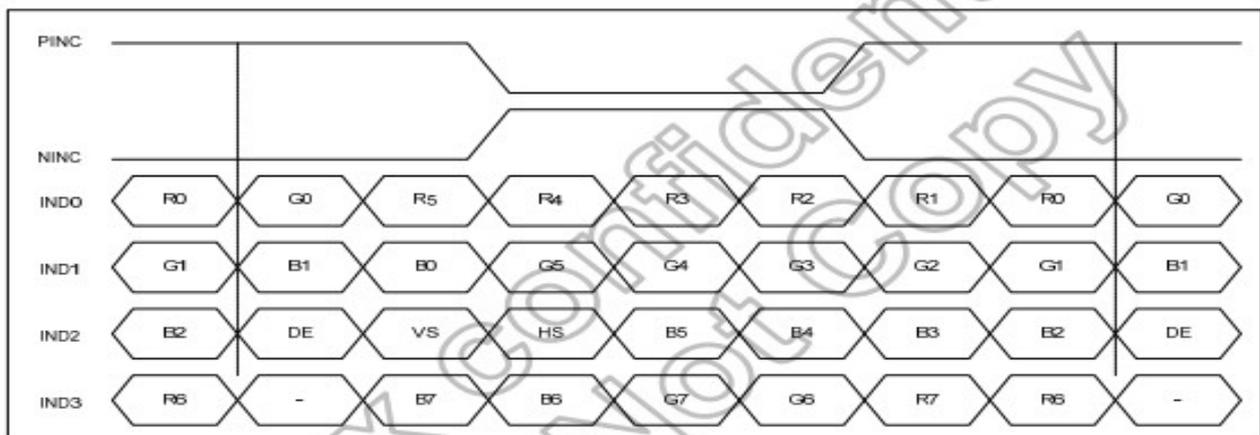
Figure 10.5: 8-bit LVDS input

4. Optical Specifications

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle		θU	CR≥10	-	85	-	degree	3
		θD		-	85	-		
		θL		-	85	-		
		θR		-	85	-		
Contrast Ratio		CR	Θ=0°	600	800	-	-	4
Response Time		TRT	25℃	-	30	35	ms	5
Chromaticity	White	X	LCM	−0.03	0.270	＋0.03	-	1
		Y			0.280			
Luminance (center)		L		350	400	-	cd/m2	1
Luminance Uniformity		ΔL		75	80	-	%	1.2
NTSC		ΔL		-	50	-	%	

Note：The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 9 measured spots. Measurement equipment BM-7 (Φ8mm)

Measuring condition:

- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

The measured value is more than 5 minutes at the center point of the LCD panel, and the backlight is turned on at the same time.
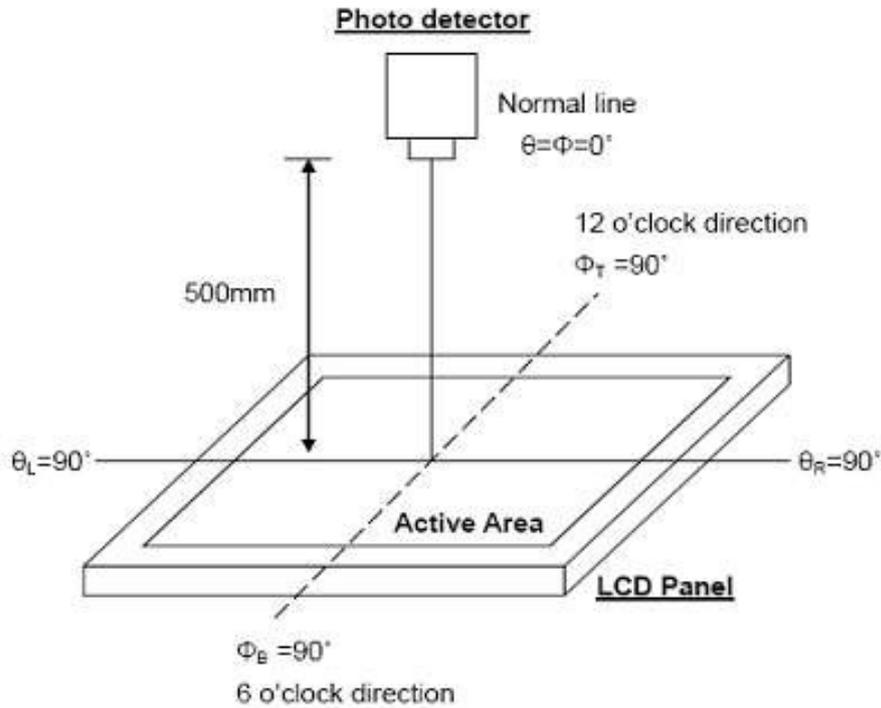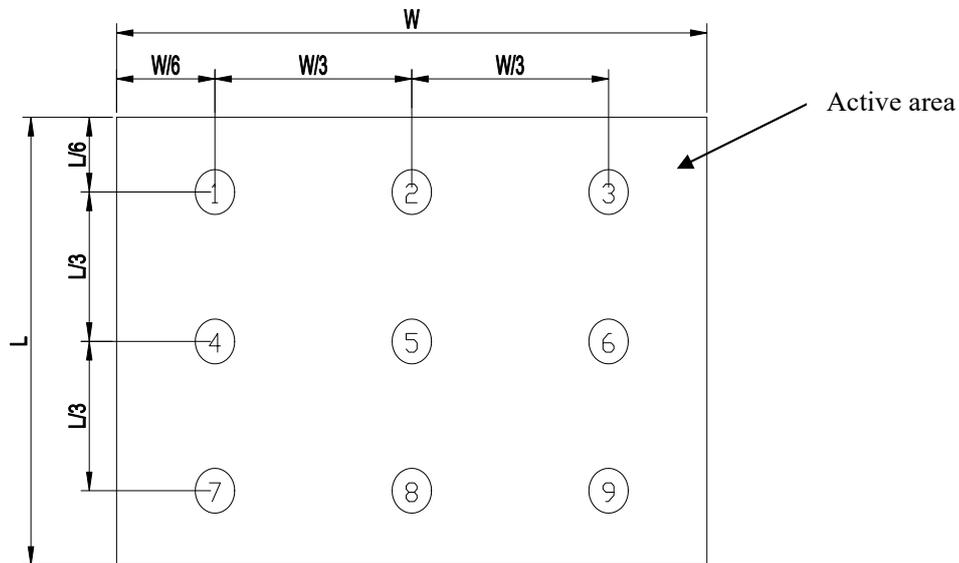
Note 2: The luminance uniformity is calculated by using following formula.
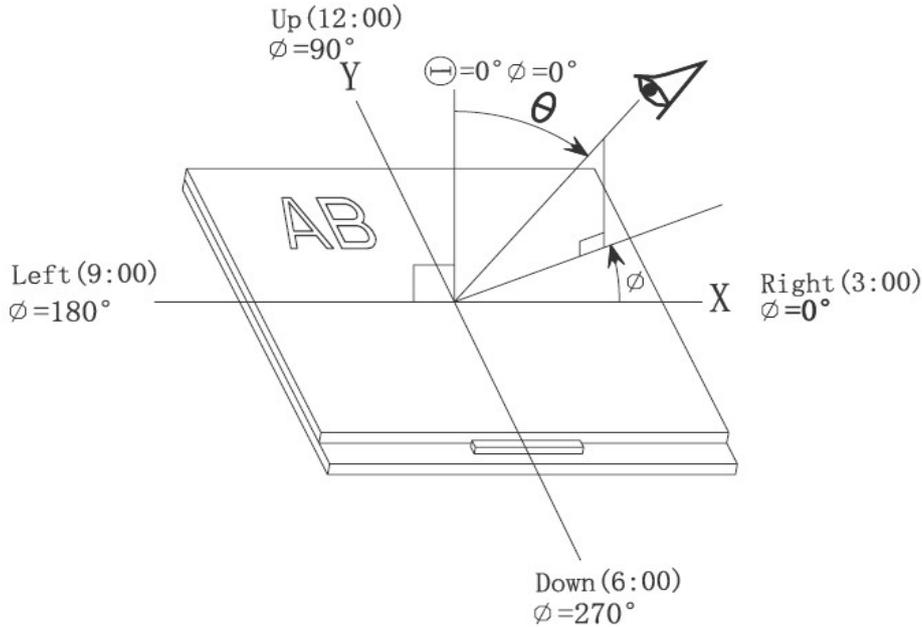
$\triangle Bp = Bp\ (Min.) / Bp\ (Max.) \times 100\ (\%)$

Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.

Note 3: The definition of viewing angle:

Refer to the graph below marked by θ and Φ

Note 4: Definition of contrast ratio

Contrast measurements shall be made at viewing angle of Θ= 0 and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

Note 5: Definition of Response time

The output signals of photo detector are measured when the input signals are changed from "white" to "black"(Tf) and from "black" to "white"(Tr), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.
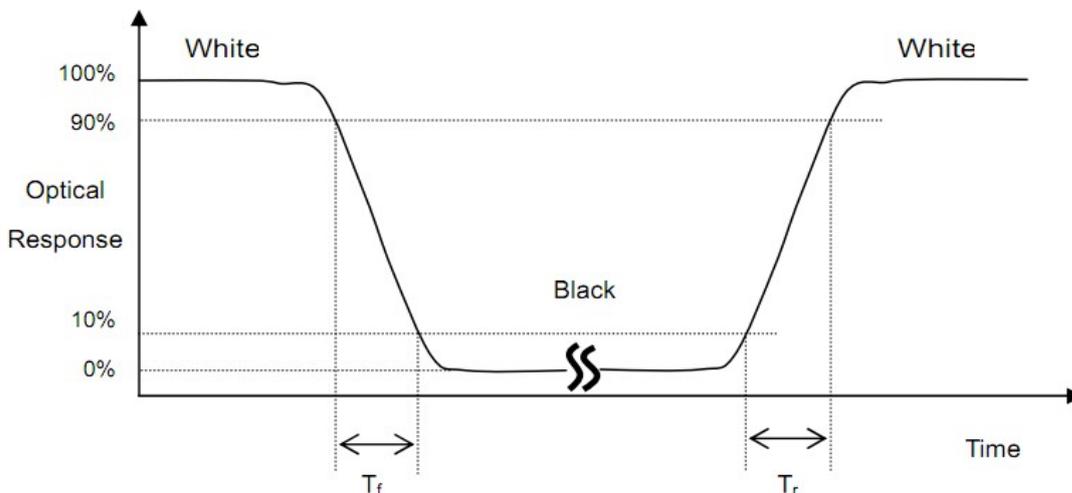
5. Reliability Test Items

Item	Test Conditions	Remark
High Temperature Storage	Ta=70℃ 96hrs	Note1 ,Note4
Low Temperature Storage	Ta=-20℃ 96hrs	Note1, Note4
High Temperature Operation	Ta=60℃ 96hrs	Note2 ,Note4
Low Temperature Operation	Ta=-20℃ 96hrs	Note2 ,Note4
Operation at High Temperature and Humidity	Ta=60℃,85%RH 96hrs	Note4
Thermal Shock	-20℃/30min~+60℃/30min for a total 24 cycles	Start with cold temperature and end with high temperature
Elector Static Discharge	Contact:±4KV,Air:±8K, Human Body Mode，150pF/330Ω	Human Body Mode
Image Sticking	25℃ ; 1hrs	Note5:6*8check pattern,25±2℃；Aging Time:1hrs；Recovery Time：5min@127/256 Gray Level。

Note1: Ta is the ambient temperature of samples.

Note2: Ts is the temperature of panel's surfaces.

Note3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note4: before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note5: Condition of image sticking test :25℃±2℃, Operation with test pattern sustained for 1 H,then change to gray pattern immediately. after 5 mins, the mura must be disappeared completely.
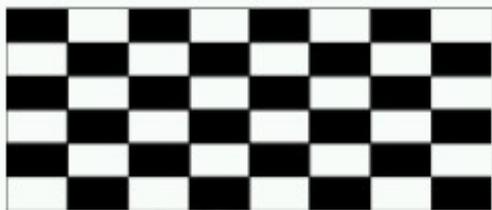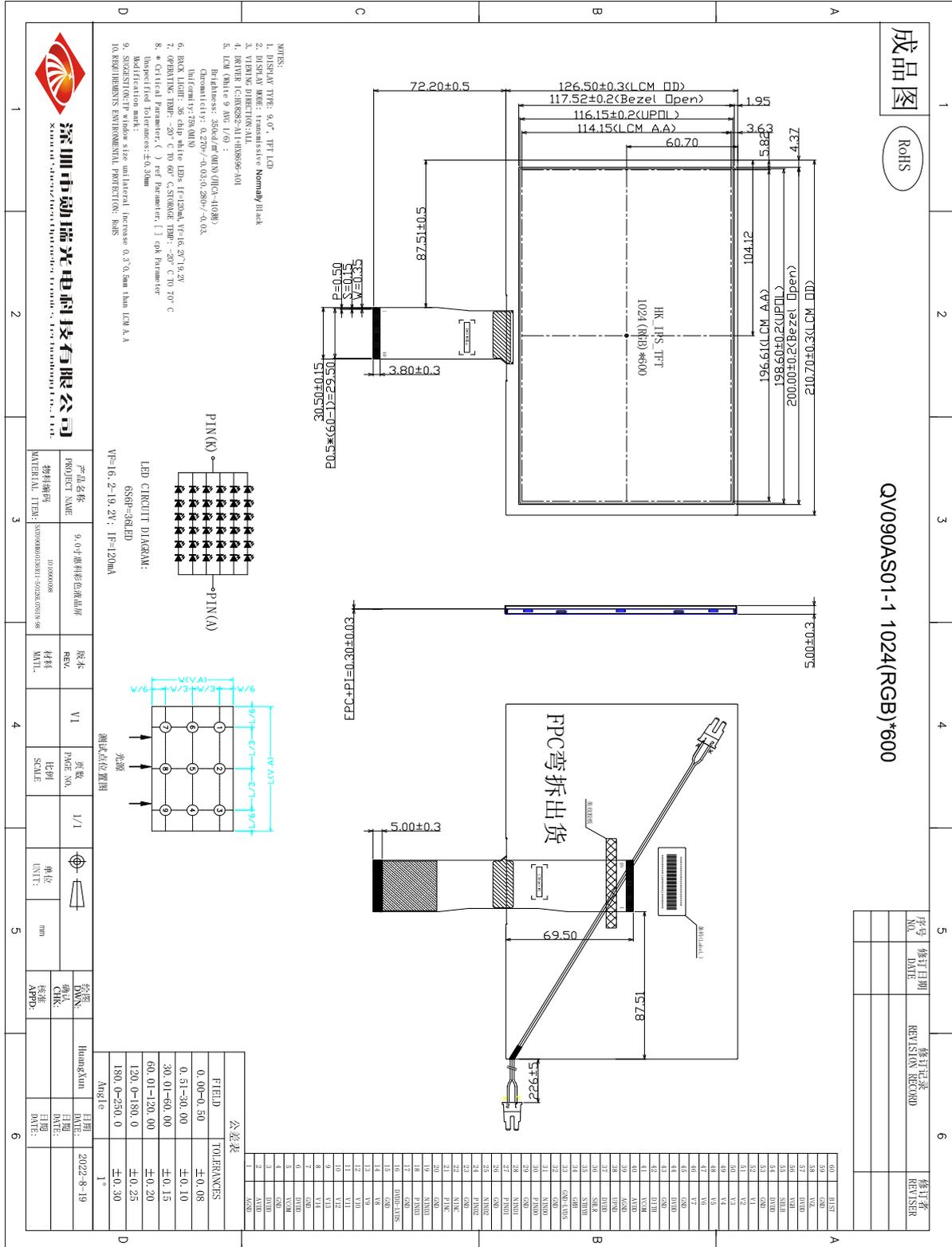
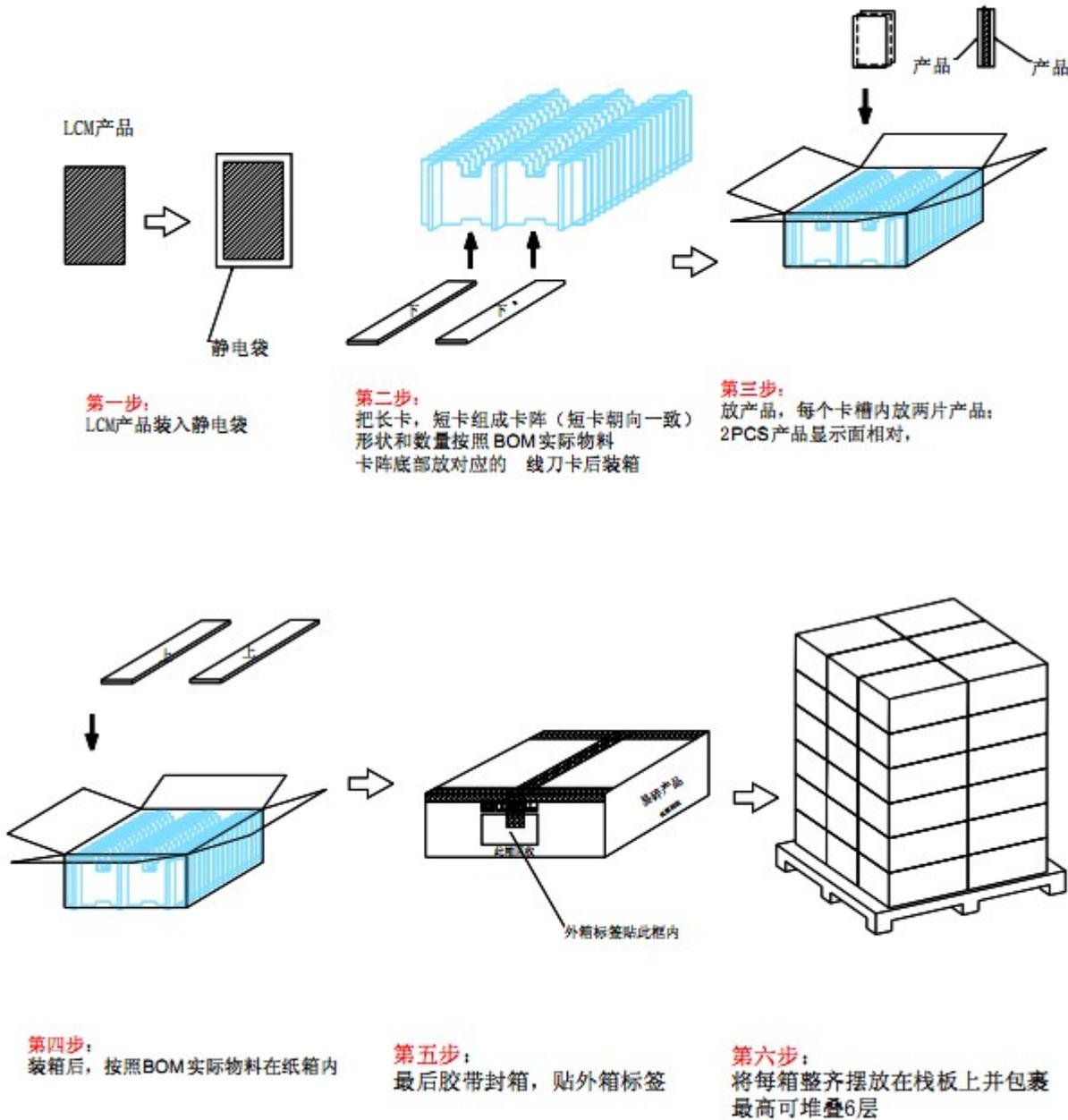Image Sticking –pattern

Lv127 Gray pattern

6. Mechanical Drawing

7. Package Drawing

包装说明

第一步：
LCM产品装入静电袋

第二步：
把长卡，短卡组成卡阵（短卡朝向一致）
形状和数量按照 BOM 实际物料
卡阵底部放对应的　线刀卡后装箱

第三步：
放产品，每个卡槽内放两片产品；
2PCS产品显示面相对，

第四步：
装箱后，按照BOM实际物料在纸箱内

第五步：
最后胶带封箱，贴外箱标签

第六步：
将每箱整齐摆放在栈板上并包裹
最高可堆叠6层

8. Numbering System

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A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K** **L**		**M**
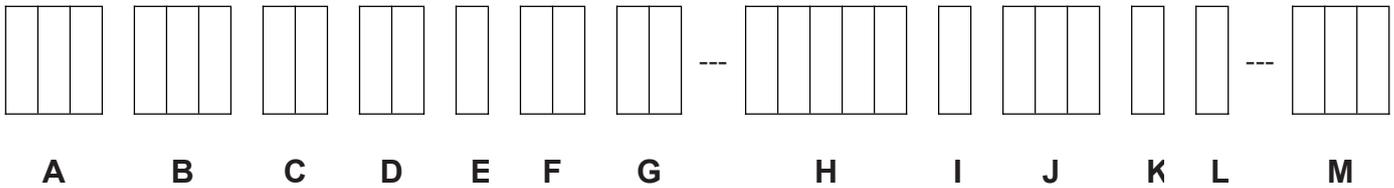
NO.	Definition	Specifications
A	Company code	SAT INTERNATIONAL CO.LTD.
B	Display monitor opposite angle line size	Unit : inch (size<10inch:take two integers;size>=10inch:takes three integers)
C	LCD Brands	AU-AUO；CP-CPT；IV-IVO；TM-TIANMA；HS-HSD；CM-CMO；BO-BOE；AT--INNOLUX；
D	Interface PIN Number	Arabic numerals from 01 to 99
E	LCD Type	A--Alternated Video Signal; D--Data Video Signal; H--High Definition ; I--IPS
F	Backlight LED Number	Arabic numerals from 01 to 99
G	Backlight Color Are	Include R1、R2、Y0、Y1、B1、B2;
H	Structure Size	Include module length and width size
I	Interface Mode	T:TTL L:LVDS M:MIPI
J	FPC Length	It represents the length of FPC with three figures, divided into long rows ,middle rows and short rows
K	View Angles	Z : represent narrow viewing angle K : represent wide viewing angle I : represent all viewing angle
L	Operating Mode	D: DE mode V: VSD mode F: Inverting mode N: No mode requirements
M	Suffix	1. NULL ; 2. TP/CTP-- Touch panel; 3. other--Insignificance