



SPECIFICATION FOR TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE : _____

HL MODEL : HG097QX005

Preliminary Specification

Final Specification

Customer Confirmation column:

Approved by : _____ Dept. : _____ Data : _____

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Designed by	Checked by	Approved by



Revision Status

Version	Revise Date	Page	Content	Modified by
V1.0	2020.3.23	-	First issued.	M



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1. General Description

1.1 Description

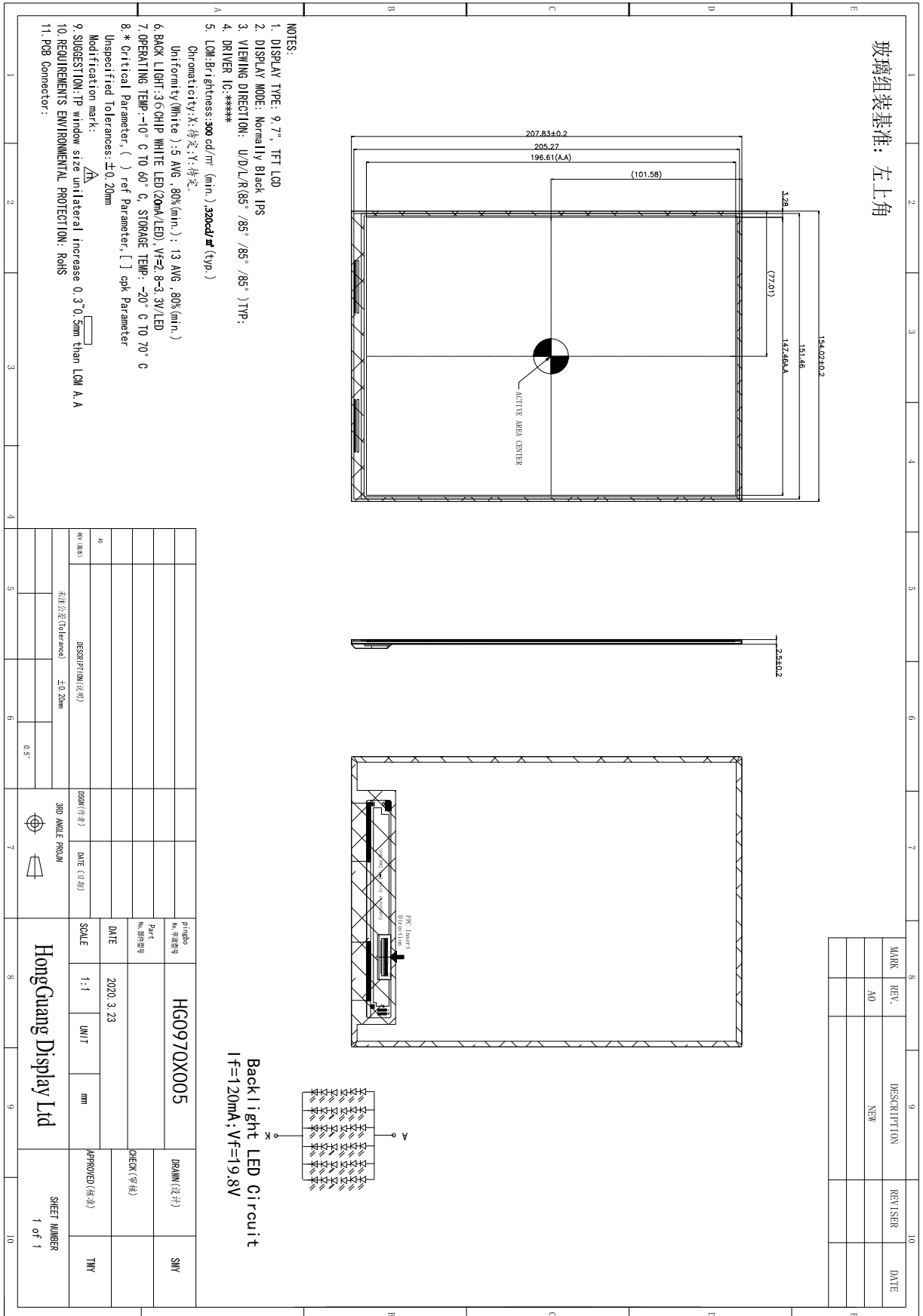
HG097QX005 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is composed of a TFT LCD panel, Driver IC, FPC and Backlight.

1.2 Features:

No.	Item	Specification	Unit
1	Panel Size	9.7"	inch
2	Number of Pixels	1536×RGB (3) ×2048	pixels
3	Active Area	147.456(H) x 196.608(V)	mm
4	Pixel Pitch	0.096×0.096	mm
5	Outline Dimension	154.02(W) x207.83(H) x2.5(T)	mm
6	Number of Colors	16.7M	-
7	Display Mode	Normally black	-
8	Viewing Direction	All	-
9	Pixel Arrangement	RGB vertical stripe	-
10	Luminance (cd/m ²)	320(TYP.)	nit
11	Contrast Ratio	900(TYP.)	
12	Surface Treatment	HC	-
13	Interface	MIPI	-
14	Backlight	White LED	-
15	Operation Temperature	-10~60	°C
16	Storage Temperature	-20~70	°C
17	Weight	TBD	g



2. Mechanical Drawing





3. Pin Description

No.	Symbol	Functions	Notes
1-8	NC	No connection	
9-10	AVEE	AVEE(-5.5V)	
11	NC	No connection	
12-13	AVDD	AVDD(+5.5V)	
14	NC	No connection	
15-16	VDDIO	Logic power 1.8V	
17	RESET	Reset Pin(1.8V)	
18	NC	No connection	
19-21	NC	LED Anode	
22	GND	No connection	
23	D0P	MIPI data positive singal	
24	D0N	MIPI data positive singal	
25	GND	Ground	
26	D1P	MIPI data positive singal	
27	D1N	MIPI data positive singal	
28	GND	Ground	
29	MIPI_CLKP	MIPI CLK positive singal	
30	MIPI_CLKN	MIPI CLK positive singal	
31	GND	Ground	
32	MIPI_2P	MIPI data positive singal	
33	MIPI_2N	MIPI data positive singal	
34	GND	Ground	
35	MIPI_3P	MIPI data positive singal	
36	MIPI_3N	MIPI data positive singal	
37	GND	Ground	
38	MIPI_0P	MIPI data positive singal	
39	MIPI_0N	MIPI data positive singal	
40	GND	Ground	
41	D1P	MIPI data positive singal	
42	D1N	MIPI data positive singal	
43	GND	Ground	
44	MIPI_CLKP	MIPI CLK positive singal	
45	MIPI_CLKN	MIPI CLK positive singal	
46	GND	Ground	
47	MIPI_2P	MIPI data positive singal	
48	MIPI_2N	MIPI data positive singal	
49	GND	Ground	
50	MIPI_3P	MIPI data positive singal	
51	MIPI_3N	MIPI data positive singal	
52	GND	Ground	
53-58	LED-	LED Cathode	
59	NC	No connection	
60-61	LED+	LED Anode	



4. Electrical Characteristics

4.1 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Conditions
Power Voltage	VDD	-0.3	4.0	V	
Input Signal Voltage	V _i	-0.3	VDD	V	

4.2 DC Characteristics

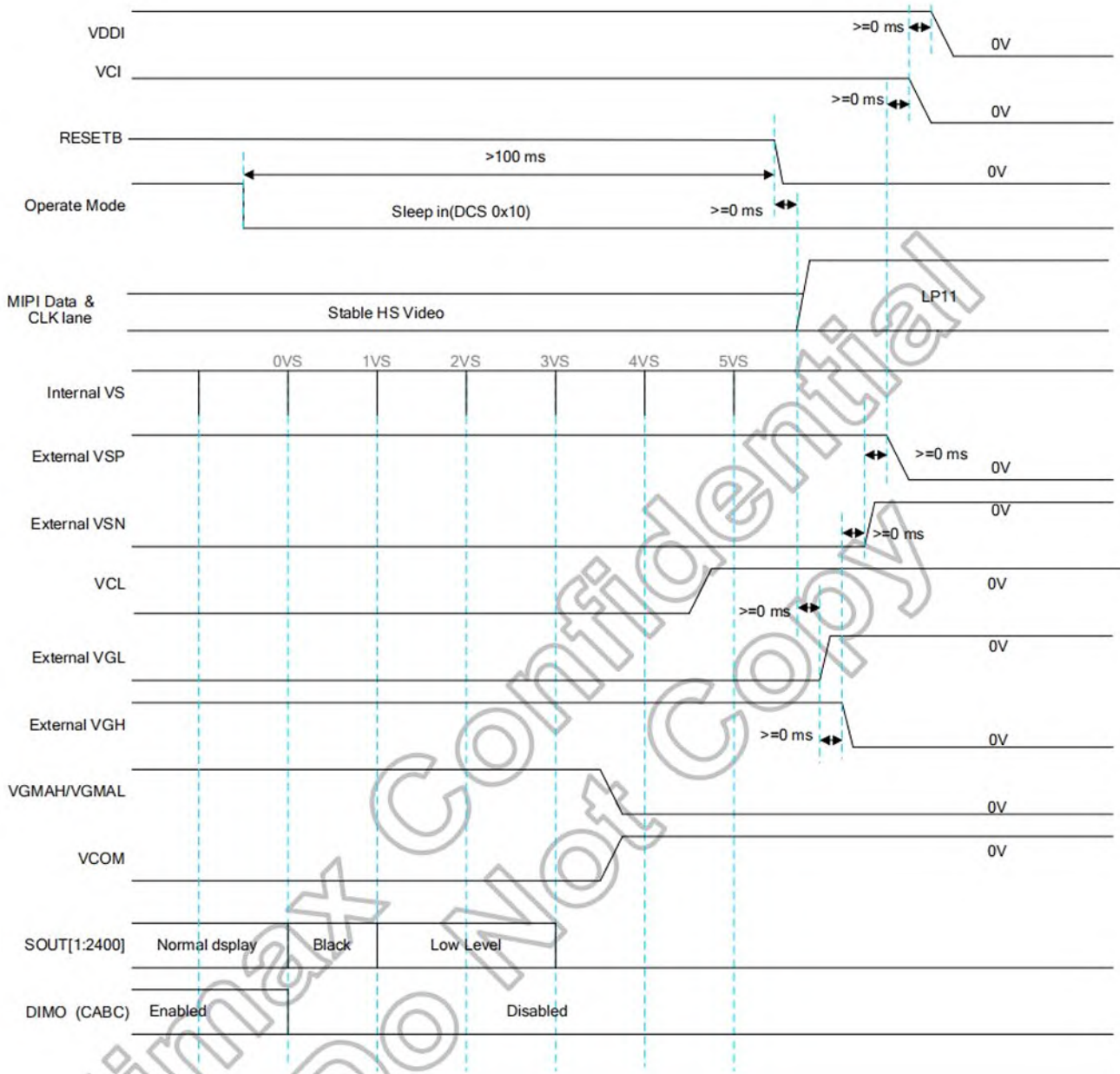
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Logic/LCD Drive Voltage	IOVCC	1.7	1.8	1.9		
VDD Power	PDD			0.46	Wt	
IDD Current	IDD			153	mA	
Inrush Current	IRush			1500	mA	

4.3 LED Back light specification

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LED Current	I _{LED}		120		mA	36LEDS
Forward Voltage	V _F	-	19.8	-	V	I _F =120mA 36LEDS
Reverse Current	I _r	-	-	30	uA	V _R =10V, 1LED
Power dissipation	P _d	2598			mW	36LEDS



4.4 Power ON/OFF Sequence





5. Sequential Chart

5.1 Timing Setting

Parameter	Symbol	Resolution						Unit
		1600RGBx2560			1536RGBx2560			
		Min.	Typ.	Max.	Min.	Typ.	Max.	
PCLK frequency	-	-	149	-	-	144	-	MHz
Horizontal total	THT	940	960	1600	908	928	1536	DCLK
Horizontal synchronization	THS	10	24	-	10	24	-	DCLK
Horizontal back porch	THB	70	80	-	70	80	-	DCLK
Horizontal address	THA	-	800	-	-	768	-	DCLK
Horizontal front porch	THF	50	80	-	50	80	-	DCLK
Vertical frequency	-	-	60	-	-	60	-	Hz
Vertical total	TVT	2584	2592	3000	2584	2592	3000	THT
Vertical synchronization	TVS	1	2	-	1	2	-	THT
Vertical back porch	TVB	8	12	-	8	12	-	THT
Vertical address	TVA	-	2560	-	-	2560	-	THT
Vertical front porch	TVF	16	20	-	16	20	-	THT

6. Optical Characteristics

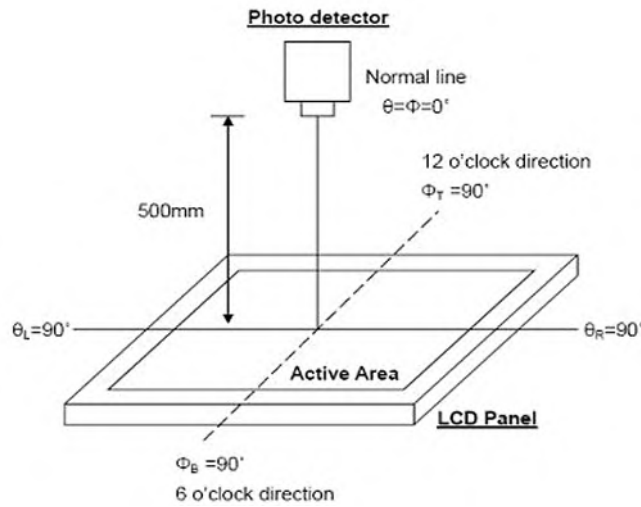
Ta=25°C±2

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio	CR	$\Theta = 0^\circ$	800	1000	-		Note1 Note4
Luminance	YL		300	320	-	cd/m ²	Note1 Note6 Note7
Luminance Uniformity	IV-M		65	75	-	%	
Response Time (Rising + Falling)	TRT	Ta= 25°C $\Theta = 0^\circ$	-	35	45	ms	Note1 Note3
Viewing Angle range	Horizontal	Θ L	CR = 10	80	85	-	Note2
		Θ R		80	85	-	
	Vertical	Θ U		80	85	-	
		Θ D		80	85	-	
Color Chromaticity	White	x	CIE 1931	-0.03	0.311	+0.03	Note1 Note5 Note7
		y			0.328		
	Red	x			TBD		
		y			TBD		



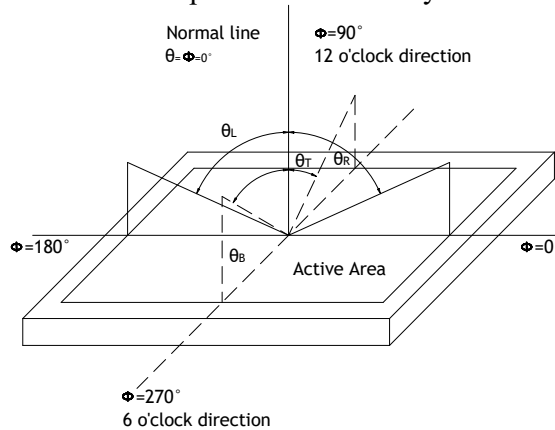
	Green	x			TBD		
		y			TBD		
	Blue	x			TBD		
		y			TBD		
NTSC				60	68	-	%

Note1: Definition of optical measurement system



Note2: Definition of viewing angle range and measurement system

Viewing angle is measured at the center point of the LCD by CONOSCOPE (ergo-80).



Note3: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.

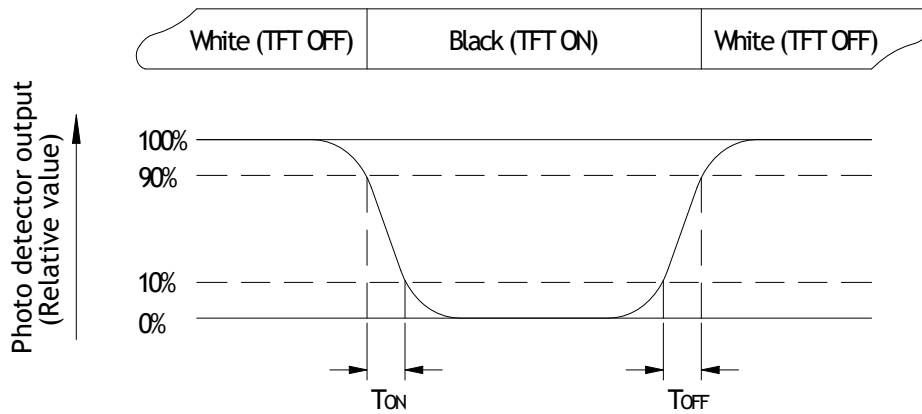


Fig. 6-3 Definition of response time

Note4: Definition of contrast ratio

Contrast ratio(CR)=

“White state “: The state is that the LCD should drive by V_{white} .

“Black state”: The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

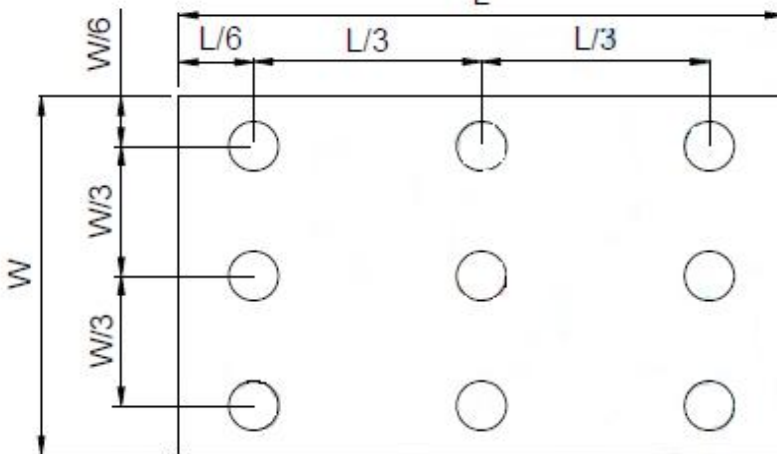
Note6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_L=120mA$

Note7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas. Every measuring point is placed at the center of each measuring area.

Luminance Uniformity (U) = L_{min} / L_{max}

L----Active area length, W---- Active area width



B_{max} : The measured maximum luminance of all measurement position.

B_{min} : The measured minimum luminance of all measurement position.



7. Quality Assurance System

7.1 Temperature and Humidity

Test Item	Test Condition	Remark
HighTemperatureStorage	Ta=70°C; 72hrs	IEC60068-2-1: 2007 GB2423.2-2008
Low Temperature Storage	Ta=-20°C; 72hrs	IEC60068-2-1: 2007 GB2423.1-2008
High Temperature Operation	Ta=60°C; 72hrs	IEC60068-2-1: 2007 GB2423.2-2008
Low Temperature Operation	Ta=-10°C; 72hrs	IEC60068-2-1: 2007 GB2423.1-2008
High Temperature High Humidity Operation	Ta=50 °C , 90%RH , 72Hrs(no condensation)	IEC60068-2-78: 2001 GB/T2423.3-2006
Thermal Shock	-20 °C (0.5h) ~ 70 °C (0.5h) / 10cycles	Start with cold temperature , End with high temperature, IEC60068-2-14:1984,GB2423.22-2002

7.2ESD

Test item	Conditions	Remark	
Electro Static Discharge Test (non-operation)	150pF, 330Ω, Contact:±4KV,Air:±8KV	1	IEC61000-4-2: 2001 GB/T17626.2-2006
	200pF, 0Ω, ±200V contact test	2	

Note: Measure point :

1. LCD glass and metal bezel
2. IF connector pins



8. Precaution Relating Product Handling

8.1 Safety

- (1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
- (2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
- (3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

8.2 Storage Conditions

- (1) Store the panel or module in a dark place where the temperature is $23\pm 5^{\circ}\text{C}$ and the humidity is below $50\pm 20\%\text{RH}$.
- (2) Store in anti-static electricity container.
- (3) Store in clean environment, free from dust, active gas, and solvent.
- (4) Do not place the module near organic solvents or corrosive gases.
- (5) Do not crush, shake, or jolt the module.

8.3 Handling Precautions

- (1) Avoid static electricity which can damage the CMOS LSI.
- (2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface.
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of the plate.
- (6) Do not use ketonic solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.
- (9) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (10) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (11) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.

8.4 Warranty

- (1) The period is within twelve months since the date of shipping out under normal using and storage conditions.
- (2) Do not repaired or modified the LCM. It may cause function to lose efficacy, PINGBO does not warrant the LCM.

All process and material comply ROHS.

9. Package Drawing

TBD



10 . Initial Code

Video Timing :

HFP : 81

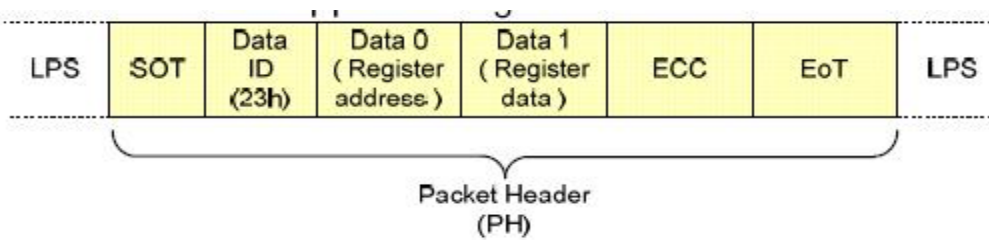
Hsync :24

HBP : 81

VFP : 17

Vsync : 23

VBP : 12



Recommended Power on Initial Sequence					
Step	Instruction	Description			
1	Write initial code	Initial setting to display			
	DATA ID	DATA 0	DATA 1	ECC	Description
	0x23	0xB0	0x00	(ECC)	Function/voltage setting ↓
	0x23	0xB2	0x02	(ECC)	
	0x23	0xB3	0x01	(ECC)	
	0x23	0xB4	0x00	(ECC)	
	0x23	0xB6	0x80	(ECC)	
	0x23	0xBB	0x53	(ECC)	VCOM setting
	0x23	0xBE	0x2F	(ECC)	VGH setting
	0x23	0xBF	0x1A	(ECC)	VGL setting
	0x23	0xF0	0x39	(ECC)	
	0x23	0xF1	0x22	(ECC)	modified on 2018.03.02 , ver 4
	0x23	0xB0	0x02	(ECC)	Gamma setting ↓
	0x23	0xC0	0x00	(ECC)	VP0
	0x23	0xC1	0x06	(ECC)	VP1
	0x23	0xC2	0x16	(ECC)	VP4
	0x23	0xC3	0x1C	(ECC)	VP8
	0x23	0xC4	0x2B	(ECC)	VP16
	0x23	0xC5	0x20	(ECC)	VP28
	0x23	0xC6	0x20	(ECC)	VP40
	0x23	0xC7	0x1F	(ECC)	VP56
0x23	0xC8	0x1C	(ECC)	VP72	



0x23	0xC9	0x15	(ECC)	VP96
0x23	0xCA	0x16	(ECC)	VP128
0x23	0xCB	0x11	(ECC)	VP152
0x23	0xCC	0x15	(ECC)	VP176
0x23	0xCD	0x1D	(ECC)	VP192
0x23	0xCE	0x1D	(ECC)	VP204
0x23	0xCF	0x1D	(ECC)	VP216
0x23	0xD0	0x23	(ECC)	VP228
0x23	0xD1	0x21	(ECC)	VP240
0x23	0xD2	0x21	(ECC)	VP248
0x23	0xD3	0x24	(ECC)	VP252
0x23	0xD4	0x16	(ECC)	VP254
0x23	0xD5	0x1F	(ECC)	VP255
0x23	0xD6	0x00	(ECC)	VN0
0x23	0xD7	0x06	(ECC)	VN1
0x23	0xD8	0x16	(ECC)	VN4
0x23	0xD9	0x1C	(ECC)	VN8
0x23	0xDA	0x2B	(ECC)	VN16
0x23	0xDB	0x20	(ECC)	VN28
0x23	0xDC	0x20	(ECC)	VN40
0x23	0xDD	0x1F	(ECC)	VN56
0x23	0xDE	0x1C	(ECC)	VN72
0x23	0xDF	0x15	(ECC)	VN96
0x23	0xE0	0x16	(ECC)	VN128
0x23	0xE1	0x11	(ECC)	VN152
0x23	0xE2	0x15	(ECC)	VN176
0x23	0xE3	0x1D	(ECC)	VN192
0x23	0xE4	0x1D	(ECC)	VN204
0x23	0xE5	0x1D	(ECC)	VN216
0x23	0xE6	0x23	(ECC)	VN228
0x23	0xE7	0x21	(ECC)	VN240
0x23	0xE8	0x21	(ECC)	VN248
0x23	0xE9	0x24	(ECC)	VN252
0x23	0xEA	0x16	(ECC)	VN254
0x23	0xEB	0x1F	(ECC)	VN255
0x23	0xB0	0x01	(ECC)	GOA MUX setting
0x23	0xC0	0x10	(ECC)	
0x23	0xC1	0x0F	(ECC)	
0x23	0xC2	0x0E	(ECC)	



0x23	0xC3	0x0D	(ECC)	
0x23	0xC4	0x0C	(ECC)	
0x23	0xC5	0x0B	(ECC)	
0x23	0xC6	0x0A	(ECC)	
0x23	0xC7	0x09	(ECC)	
0x23	0xC8	0x08	(ECC)	
0x23	0xC9	0x07	(ECC)	
0x23	0xCA	0x06	(ECC)	
0x23	0xCB	0x05	(ECC)	
0x23	0xCC	0x00	(ECC)	
0x23	0xCD	0x01	(ECC)	
0x23	0xCE	0x02	(ECC)	
0x23	0xCF	0x03	(ECC)	
0x23	0xD0	0x04	(ECC)	
0x23	0xD6	0x10	(ECC)	
0x23	0xD7	0x0F	(ECC)	
0x23	0xD8	0x0E	(ECC)	
0x23	0xD9	0x0D	(ECC)	
0x23	0xDA	0x0C	(ECC)	
0x23	0xDB	0x0B	(ECC)	
0x23	0xDC	0x0A	(ECC)	
0x23	0xDD	0x09	(ECC)	
0x23	0xDE	0x08	(ECC)	
0x23	0xDF	0x07	(ECC)	
0x23	0xE0	0x06	(ECC)	
0x23	0xE1	0x05	(ECC)	
0x23	0xE2	0x00	(ECC)	
0x23	0xE3	0x01	(ECC)	
0x23	0xE4	0x02	(ECC)	
0x23	0xE5	0x03	(ECC)	
0x23	0xE6	0x04	(ECC)	
0x23	0xE7	0x00	(ECC)	
0x23	0xEC	0xC0	(ECC)	
0x23	0xB0	0x03	(ECC)	GOA timing setting
0x23	0xC2	0x00	(ECC)	
0x23	0xC3	0x09	(ECC)	
0x23	0xC5	0x03	(ECC)	
0x23	0xC8	0x07	(ECC)	
0x23	0xC9	0x05	(ECC)	



	0x23	0xCA	0x41	(ECC)	
	0x23	0xCC	0x44	(ECC)	
	0x23	0xCF	0x60	(ECC)	
	0x23	0xD2	0x04	(ECC)	
	0x23	0xD3	0x04	(ECC)	
	0x23	0xD4	0x03	(ECC)	
	0x23	0xD5	0x02	(ECC)	
	0x23	0xD6	0x01	(ECC)	
	0x23	0xD7	0x00	(ECC)	
	0x23	0xDB	0x01	(ECC)	
	0x23	0xDE	0x03	(ECC)	
	0x23	0xE6	0x00	(ECC)	
	0x23	0xE7	0x09	(ECC)	
	0x23	0xB0	0x06	(ECC)	
	0x23	0xB8	0xA5	(ECC)	
	0x23	0xC0	0xA5	(ECC)	
	0x23	0xD5	0x3F	(ECC)	
2	Write DCS command		DCS command setting to display		
	0x05	0x11	0x00	(ECC)	DCS command Sleep out
	0x05	0x29	0x00	(ECC)	DCS command Display on