TFT DISPLAY SPECIFICATION

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RFC35BR-AZH-DNN

SPECIFICATION

CUSTOMER:

APPROVED BY	
PCB VERSION	
DATE	

FOR CUSTOMER USE ONLY

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

Release DATE:

TFT Display Inspection Specification: https://www.raystar-optronics.com/download/products.htm
Precaution in use of TFT module: https://www.raystar-optronics.com/download/declaration.htm

Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	2019/11/04		First issue

Contents

1.Module Classification Information

R	F	C	35	BR	-	A	Z	H	-	D	N	N
1	2	3	4	5	-	6	7	8	-	9	10	11

Item	Description		
1	R：Raystar Optronics Inc.		
2	Display Type：F→TFT Type, J→ Custom TFT		
3	Solution: A: 128x160 B:320x234 C:320x240 D:480x234 E:480x272 F:800x480 G:640x480 H:1024x600 I:320x480 J:240x320 K:1280x800 L:240x400 M:1024x768 N:128x128 O:480x800 P:640x320 Q:800x600 S:480x128 T:800x320		
4	Display Size：3.5” TFT		
5	Version Code.		
6	Model Type: A：TFT LCD E：TFT+FR+CONTROL BOARD J：TFT+FR+A/D BOARD N：TFT+FR+A/D BOARD+CONTROL BOARD S：TFT+FR+POWER BOARD (DC TO DC) 1：TFT+CONTROL BOARD		6：TFT+FR H：TFT+D/V BOARD I：TFT+FR+D/V BOARD B：TFT+POWER BD
7	Polarizer Type, Temperature range, View direction	I→Transmissive, W. T, 6:00 ; C→Transmissive, N. T, 6:00 L→Transmissive, W.T,12:00 ; F→Transmissive, N.T,12:00 Y→Transmissive,W.T, IPS TFT ; A→Transmissive, N.T, IPS TFT Z→Transmissive, W.T, O-TFT R→Transmissive, Super W.T, O-TFT N→Transmissive, Super W.T, 6:00; Q→Transmissive, Super W.T, 12:00 V→Transmissive, Super W.T, VA TFT	
8	Backlight	W：LED, White	H：LED, High Light White
		F：CCFL, White	
9	Driver Method	D: Digital A: Analog L：LVDS M:MIPI	
10	Interface	N：without control board A：8Bit B：16Bit S:SPI Interface R: RS232 U:USB I: I2C	
11	TS	N：Without TS S：resistive touch panel C：capacitive touch panel capacitive touch panel (G-F-F) G：capacitive touch panel(G-G)	

2.Summary

TFT 3.5”is a TN transmissive type color active matrix TFT liquid crystal display that use amorphous silicon TFT as switching devices. This module is a composed of a TFT_LCD module, It is usually designed for industrial application and this module follows RoHs,

3.General Specifications

- Size: 3.5 inch
- Dot Matrix: 320 x RGBx240(TFT) dots
- Module dimension: 76.84(W) x 63.84(H) x 3.27(D) mm
- Active area: 70.08 x 52.56 mm
- Dot pitch: 0.073 x 0.219 mm
- LCD type: TFT, Normally White, Transmissive
- View Direction: 12 o'clock
- Gray Scale Inversion Direction: 6 o'clock
- Interface: 8-bit/16-bit CPU or option other mode (build in controller)
- Aspect Ratio: 4:3
- Backlight Type: LED,Normally White
- IC: SSD2119
- With /Without TP: Without TP
- Surface: Anti-Glare

*Color tone slight changed by temperature and driving voltage.

4.Interface

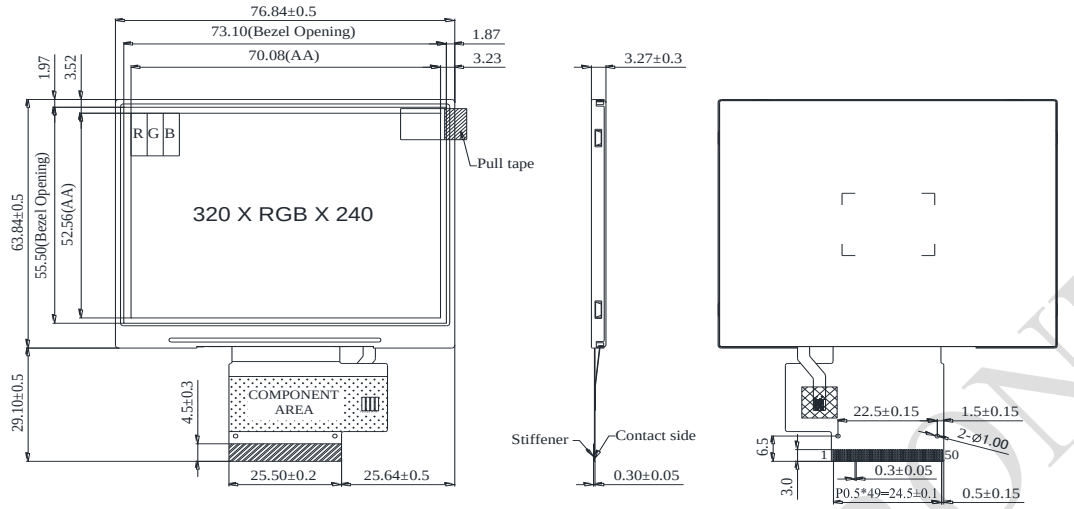
4.1. LCM PIN Definition

No.	Symbol	Description
1	VCI	Booster input voltage pin
2	VCI	Booster input voltage pin
3	VSS	Ground
4	VDDIO	Voltage input pin for logic
5	VSS	Ground
6	RESET	Reset Signal pin (“Low” is enable)
7	DC/SDC	Data or Command select PIN.
8	E/RD	6800 system: E(enable signal) 8080 system : RD(read strobe signal) Serial mode: Not use and should be connected to VDDIO or VSS
9	WR	6800 system : RW (indicates read cycle when high ,write cycle when low) 8080 system : WR (write strobe signal)
10	CS	Chip select
11	SCL	Serial Clock.
12	SD0	Serial Data output
13	SDI	Serial Data Input
14	WSYNC	Ram write synchronization output. Leave it OPEN when not used.
15~32	D17~D0	Data bus
33	VSS	Ground
34	DOTCLK	Dot-clock signal and oscillator source
35	HSYNC	Line Synchronous Signal
36	VSYNC	Frame Synchronous Signal
37	DE	Display enable pin for controller
38	VSS	Ground
39	PS0	Interface select PIN
40	PS1	
41	PS2	
42	PS3	
43	VSS	Ground
44~47	NC	NC

48	VSS	Ground
49	LEDK	Backlight LED Cathode
50	LEDA	Backlight LED Anode.

PS3	PS2	PS1	PS0	Interface Mode	Data bus input
0	0	0	0	16-bit 6800 parallel interface	D[17:10], D[8:1]
0	0	0	1	8-bit 6800 parallel interface	D[17:10]
0	0	1	0	16-bit 8080 parallel interface	D[17:10], D[8:1]
0	0	1	1	8-bit 8080 parallel interface	D[17:10]
0	1	0	0	9-bit generic D[9:16] (262k colour) + 3-wire SPI If 65K color, D12 shorts to D17 internally	
0	1	0	1	16-bit generic (262k colour) + 3-wire SPI	
0	1	1	0	18-bit generic (262k colour) + 3-wire SPI	
0	1	1	1	6-bit generic D[8:3] (262k colour) + 3-wire SPI	
1	0	0	0	18-bits 6800 parallel interface	D[17:0]
1	0	0	1	9-bits 6800 parallel interface	D[17:9]
1	0	1	0	18-bit 8080 parallel interface	D[17:0]
1	0	1	1	9-bit 8080 parallel interface	D[17:9]
1	1	1	0	3-wire SPI	
1	1	1	1	4-wire SPI	

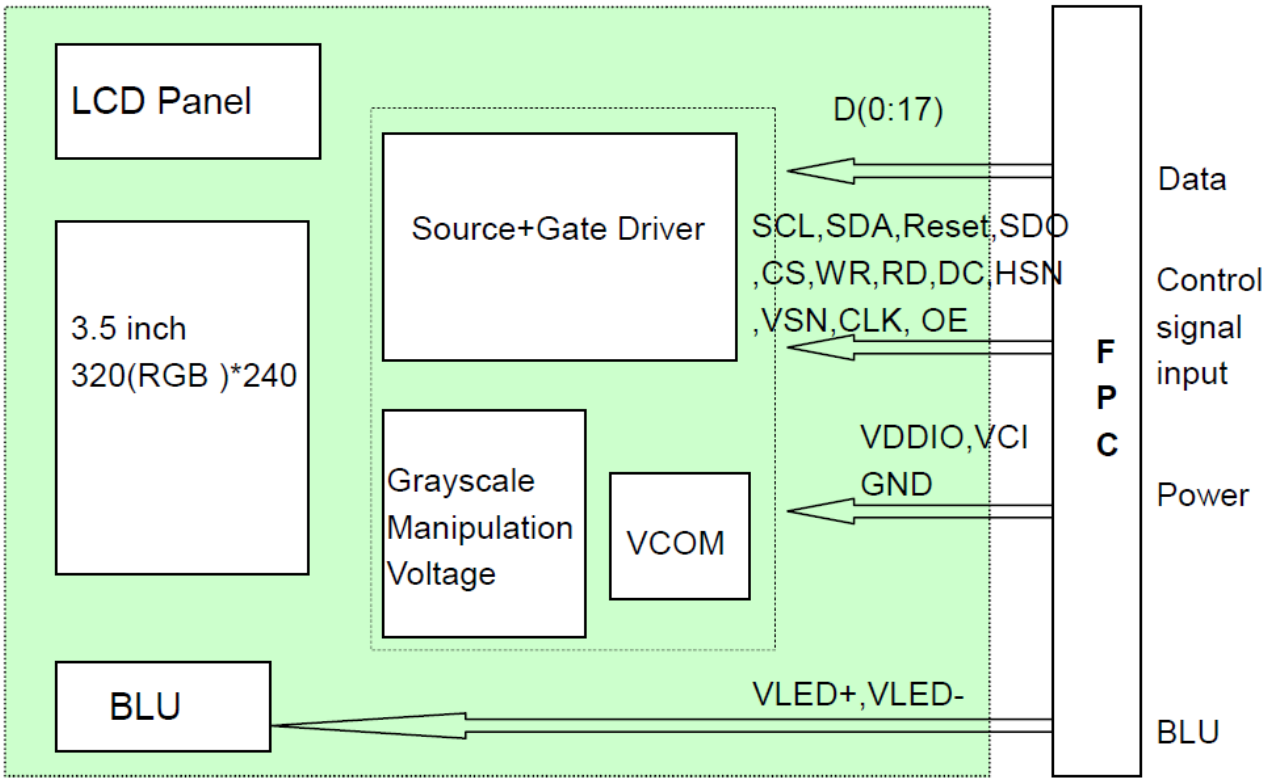
5.Contour Drawing



PIN NO.	SYMBOL	PIN NO.	SYMBOL
1	VCI	26	D6
2	VCI	27	D5
3	VSS	28	D4
4	VDDIO.	29	D3
5	VSS	30	D2
6	RESET	31	D1
7	DC/SDC(RS)	32	D0
8	E/RD	33	VSS
9	WR	34	DOTCLK
10	CS	35	HSYNC
11	SCL	36	VSYNC
12	SDO	37	DE
13	SDI	38	VSS
14	WSYNC(NC)	39	PS0
15	D17	40	PS1
16	D16	41	PS2
17	D15	42	PS3
18	D14	43	VSS
19	D13	44	NC(YU)
20	D12	45	NC(XL)
21	D11	46	NC(YD)
22	D10	47	NC(XR)
23	D9	48	VSS
24	D8	49	LEDK
25	D7	50	LEDA

The non-specified tolerance of dimension is ±0.3 mm .

6.Block Diagram



7.Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	TOP	-20	—	+70	℃
Storage Temperature	TST	-30	—	+80	℃

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp. ≦60℃, 90% RH MAX. Temp.＞60℃, Absolute humidity shall be less than 90% RH at 60℃

8.Electrical Characteristics

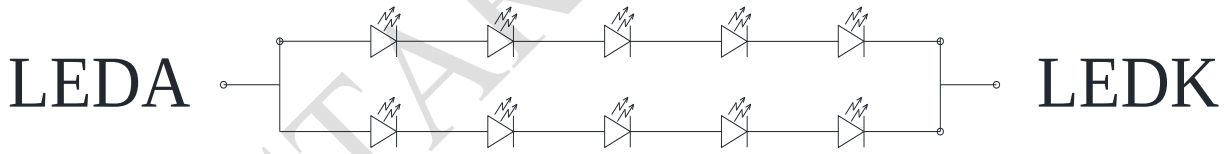
8.1. Operating conditions:

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power supply voltage	VCI	2.5	3.3	3.6	V	
Power supply pin of IO pins	VDDIO	1.4	3.3	3.6	V	
Current consumption	IVCI+IVDDIO	-	6	-	mA	
Dot clock	DCK	-	5.5	8.2	MHz	

8.2. LED driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		-	40		mA	
Power Consumption		540	620	660	mW	
LED voltage	LED+	13.5	15.0	16.5	V	Note 1
LED Life Time		-	50,000	-	Hr	Note 2,3,4

Note 1 : There are 1 Groups LED



CIRCUIT DIAGRAM

Note 2 : Ta = 25 ℃
Note 3 : Brightness to be decreased to 50% of the initial value
Note 4 : The single LED lamp case

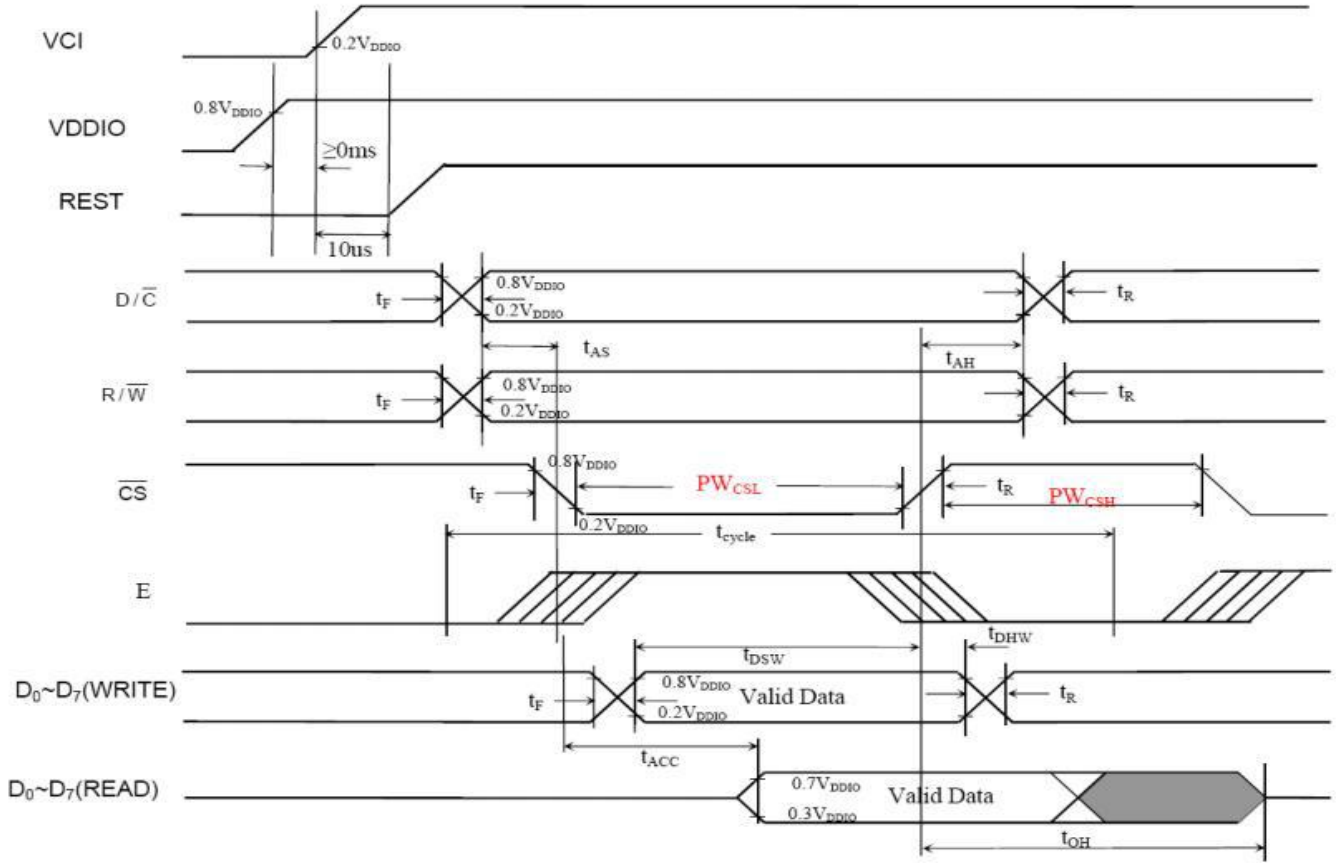
9.AC Characteristics

9.1. Parallel 6800-series Interface Timing Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
tcycle	Clock cycle time (write cycle)	75	-	-	ns
tcycle	Clock cycle time (read cycle)	1000	-	-	ns
tAS	Address setup time (R/W)	0	-	-	ns
tAH	Address hold time (R/W)	0	-	-	ns
tDSW	Data setup time(D0~D7,WRITE)	5	-	-	ns
tDHW	Data hold time(D0~D7,WRITE)	5	-	-	ns
tACC	Data access time(D0~D7,READ)	250	-	-	ns
tOH	Output hold time(D0~D7,READ)	100	-	-	ns
PWCSL	Pulse width/CS low(write cycle)	40	-	-	ns
PWCSH	Pulse width/CS high(write cycle)	25	-	-	ns
PWCSL	Pulse width/CS low(read cycle)	500	-	-	ns
PWCSH	Pulse width/CS high(read cycle)	500	-	-	ns
tR	Rise time(/CS)	-	-	4	ns
tF	Fall time(/CS)	-	-	4	ns

Note: CS can be pulled low during the write cycle, only /RW is needed to be toggled

Parallel 6800-series interface timing characteristics



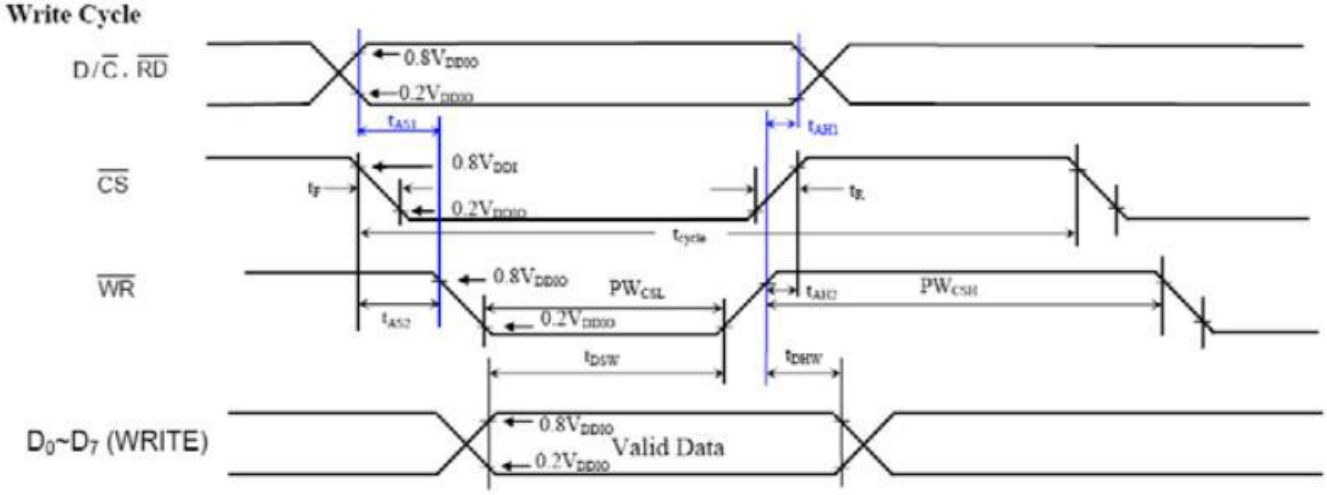
9.2. **Parallel 800 Timing Characteristics**

Symbol	Parameter	Min	Typ	Max	Unit
tcycle	Clock cycle time (write cycle)	100	-	-	ns
tAS	Address setup time	10	-	-	ns
tAH	Address hold time	0	-	-	ns
tCS	Chip select time	0			ns
tCH	Chip select hold time	0			ns
tDSW	Write Data setup time	10	-	-	ns
tDHW	Write Data hold time	10	-	-	ns
tDHR	Read Data hold time	100			ns
tACC	Access time(RAM) Access time(command)	250 250	-	-	ns ns
tPWLR tPWLR tPWLW	Chip select low pulse width(read RAM) Chip select low pulse width(read command) Chip select low pulse width(write)	500 500 50	-	-	ns ns ns
tPWHR tPWHW	Chip select high pulse width(read) Chip select high pulse width(write)	500 50	-	-	ns ns
tR	Rise time	-	-	15	ns
tF	Fall time	-	-	15	ns

Note: all timings are based on 20% to 80% of VDDIO-VSS

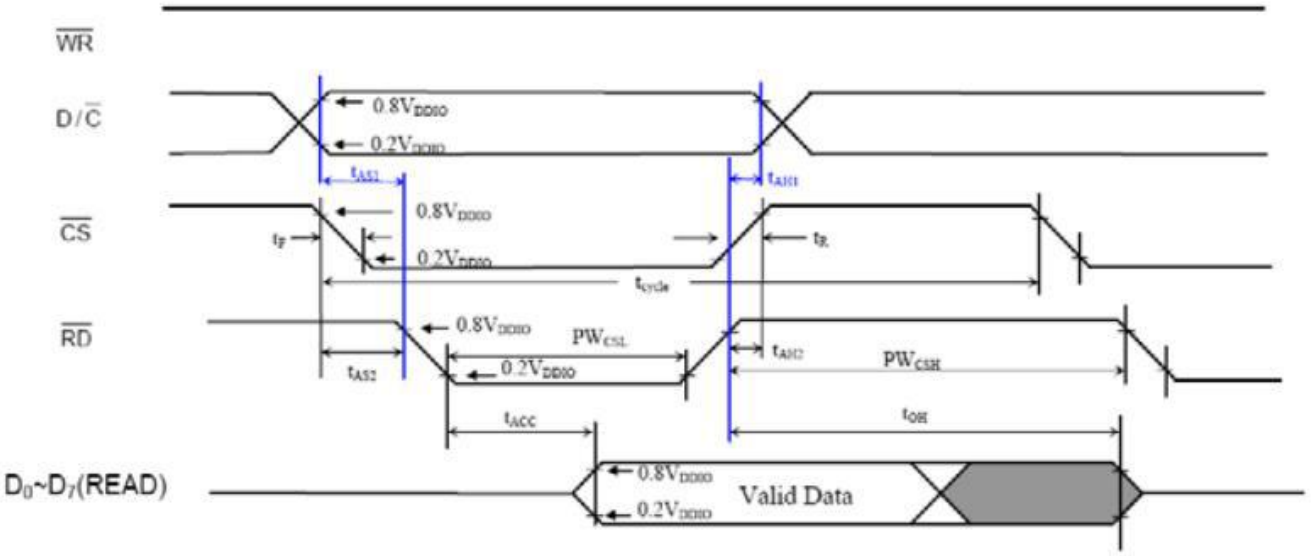
8080-series parallel interface characteristics(Form 1: /CS low pulse width＞ W/R low pulse width)

Write Cycle



Remark: It's highly recommended that $\overline{RD}$ remains high for the whole write cycle

Read Cycle

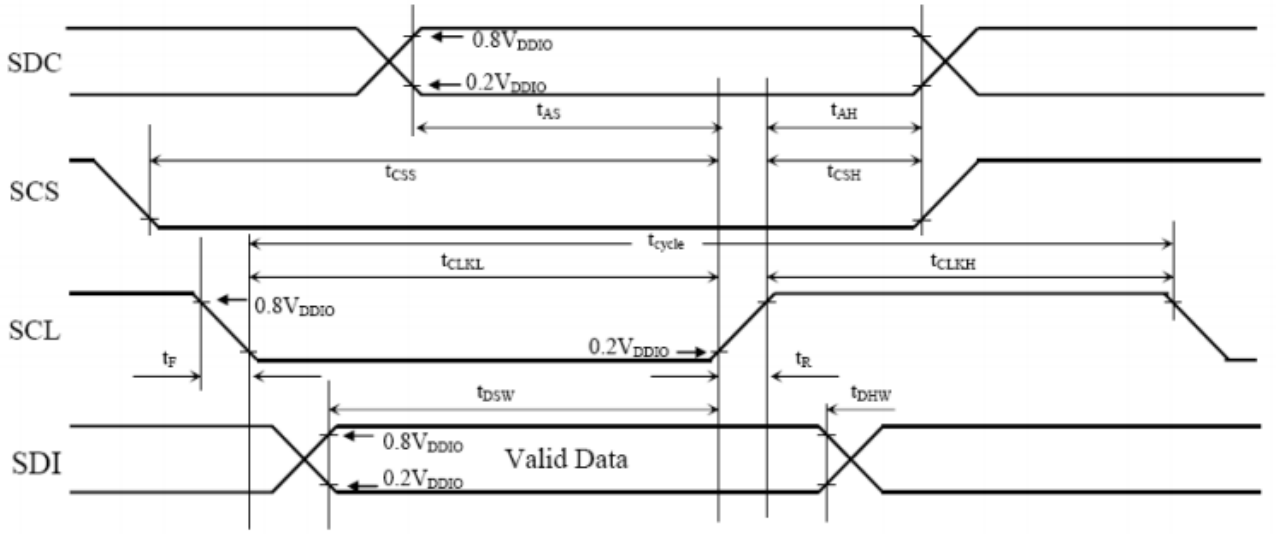


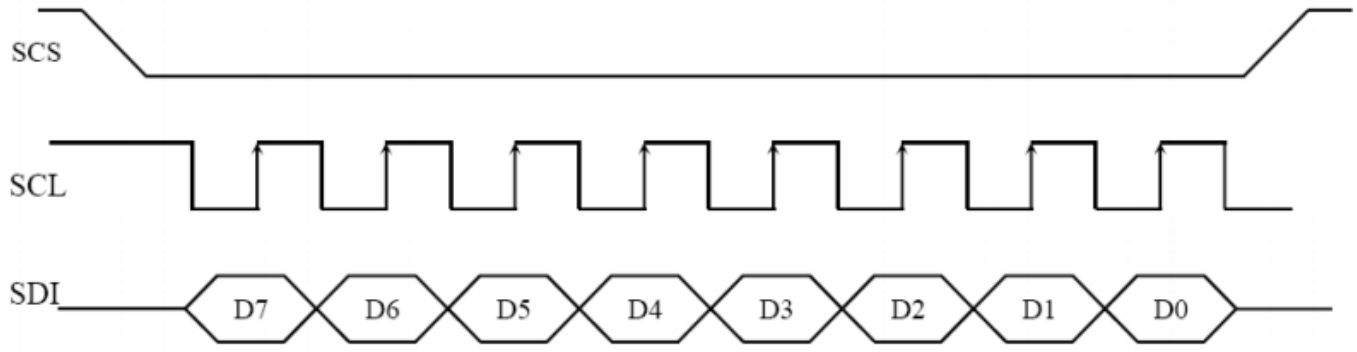
9.3. **Serial Timing Characteristics**

(Ta=-40 to 85℃, VDDIO = 1.4V to 3.6V)

Symbol	Parameter	Min	Typ	Max	Unit
tcycle	Clock cycle time	77	-	-	ns
fCLK	Serial clock cycle time SPI clock tolerance =+/- 2 ppm	-	-	15	MHz
tAS	Register select setup time	4	-	-	ns
tAH	Register select hold time	5	-	-	ns
tCSS	Chip select setup time	2			ns
tCSH	Chip select hold time	10			ns
tDSW	Write Data setup time	5	-	-	ns
tOHW	Write Data hold time	10	-	-	ns
tCLKL	Clock low time	38			ns
tCLKH	Clock high time	38	-	-	ns
tR	Rise time	-	-	4	ns
tF	Fall time	-	-	4	ns

4 wire serial timing characteristics





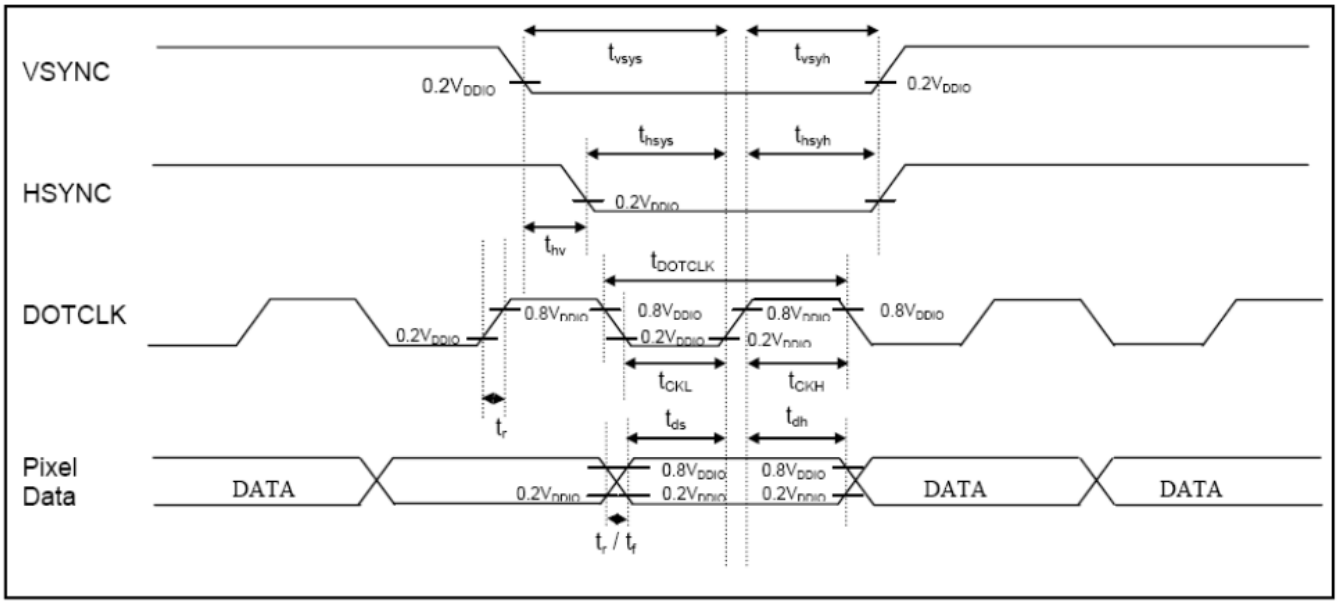
9.4. **RGB Timing Characteristics**

(Ta=-40 to 85℃, VDDIO = 1.4V to 3.6V)

Symbol	Parameter	Min	Typ	Max	Unit
fDOTCLK	DOTCLK frequency (70Hz frame rate)	1	5.5	8.2	ns
tDOTCLK	DOTCLK period	122	182	1000	ns
tVSYS	Vertical sync setup time	20	-	-	ns
tVSYH	Vertical sync hold time	20			ns
tHSYS	Horizontal sync setup time	20			ns
tHSYH	Horizontal sync hold time	20	-	-	ns
tHV	Phase difference of sync signal falling edge	0	-	320	ns
tCLK	DOTCLK low period	61	-	-	ns
tCKH	DOTCLK high period	61			ns
tDS	Data setup time	25	-	-	ns
tDH	Data hold time	25	-	-	ns
tRES	Reset pulse width	8	-	-	ns

Note: external clock source must be provided to DOTCLK pin of SSD2119. The driver will not operate in absence of the clocking signal.

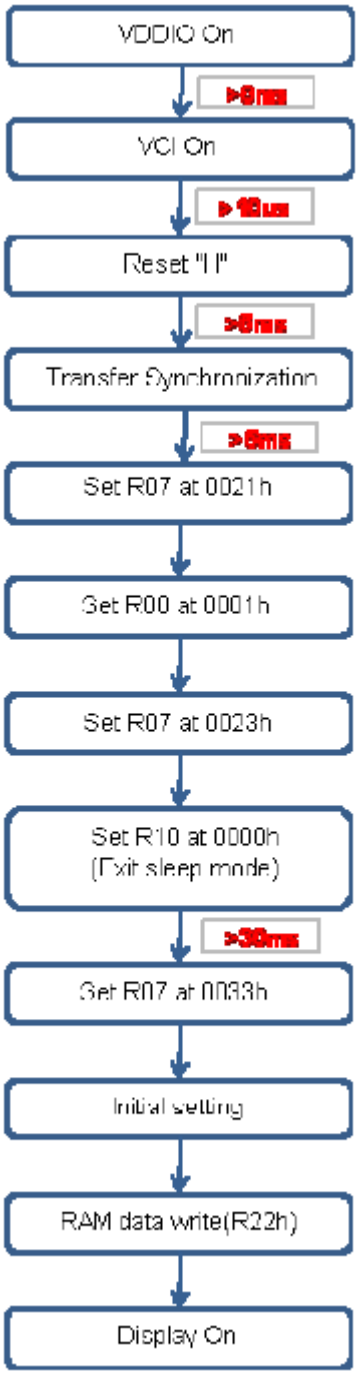
RGB timing characteristics



10.Power Sequence

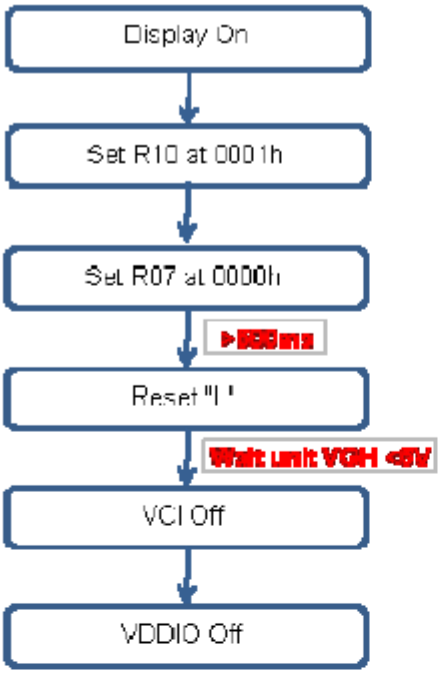
10.1. Power on sequence

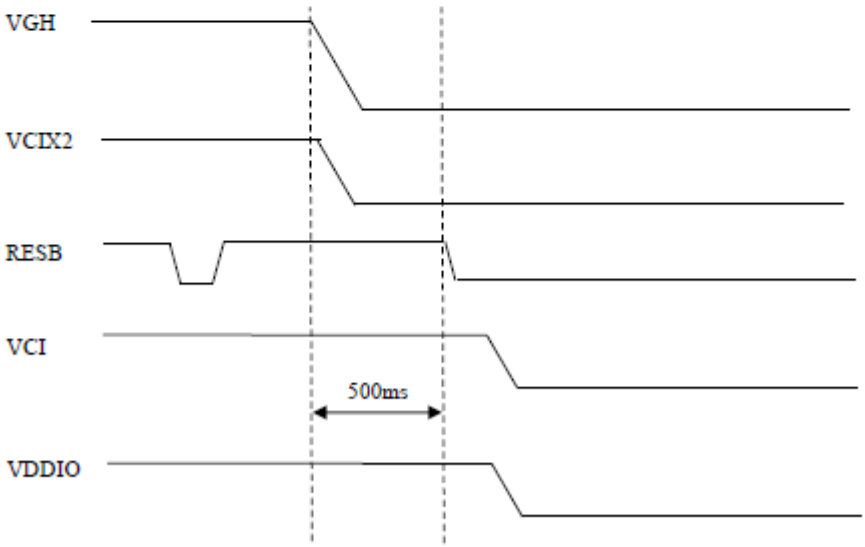
Note: To prevent potential damage to the device, all capacitors must be discharged to below 0.5V before the driver is removed from, or before the driver is attached to those components.



10.2. Power off sequence

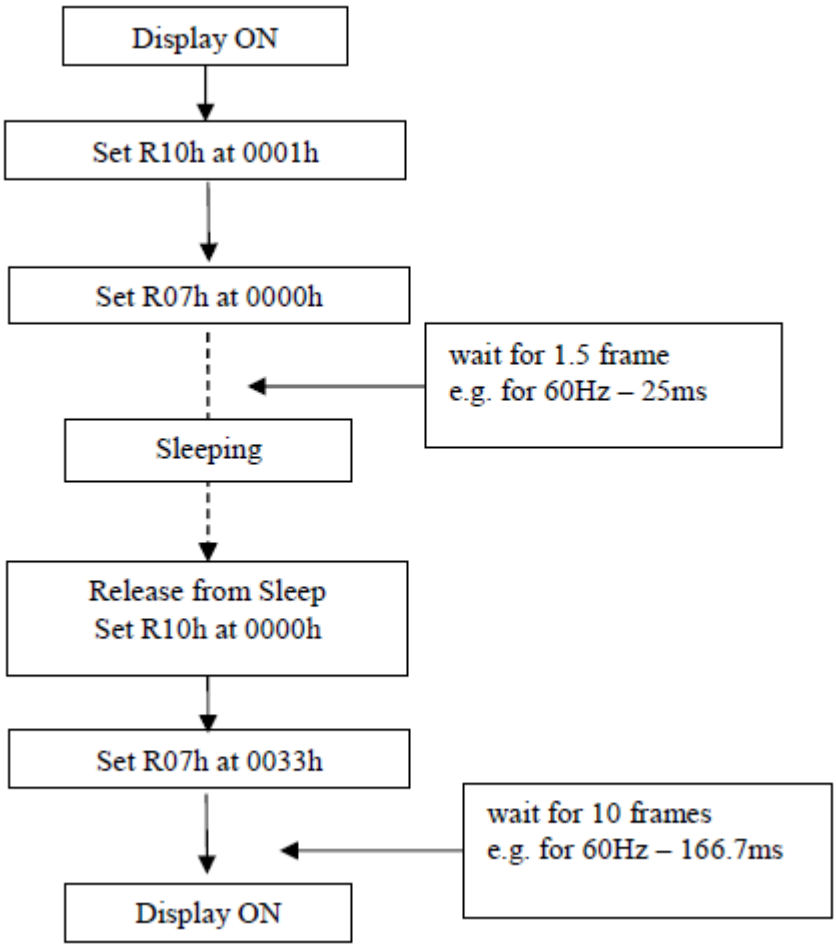
Note: To prevent potential damage to the device, all capacitors must be discharged to below 0.5V before the driver is removed from, or before the driver is attached to those components





Note:
1. VDDIO should be the last to fall, or VCI/VDDIO could be power off at the same time
2. If OTP is active in the application, the OTP programming voltage should be turned off and cap discharged before VCI/VDDIO are turned off.

Sleep mode display sequence



11.Optical Characteristics

Item		Symbol	Condition.	Min	Typ.	Max.	Unit	Remark
Response time		Tr+ Tf	θ=0°、Φ=0°	-	25	-	ms	Note 3
Contrast ratio		CR	At optimized viewing angle	300	-	-	-	Note 4
Color Chromaticity	White	Wx	θ=0°、Φ=0	0.26	0.31	0.36	-	Note 2,6,7
		Wy		0.28	0.33	0.38	-	
Viewing angle (Gray Scale Inversion Direction)	Hor.	ΘR	CR≧10	-	75	-	Deg.	Note 1
		ΘL		-	75	-		
	Ver.	ΦT		-	75	-		
		ΦB		-	75	-		
Brightness		-	-	650	750	-	cd/m^2	Center of display
Uniformity		(U)	-	75	-	-	%	Note5

Ta=25±2℃, IL=40Ma

Note: After adding a polarized O-film, its viewing angle is enlarged, but its still have gray scale appearance.

Note 1: Definition of viewing angle range

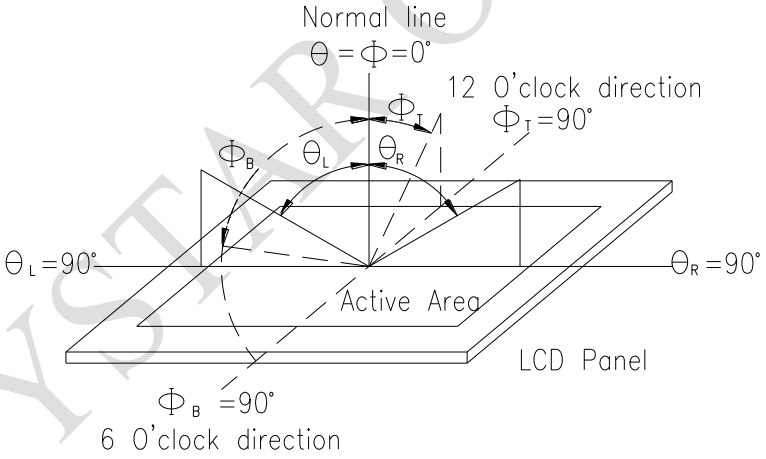


Fig. 11.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7orBM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

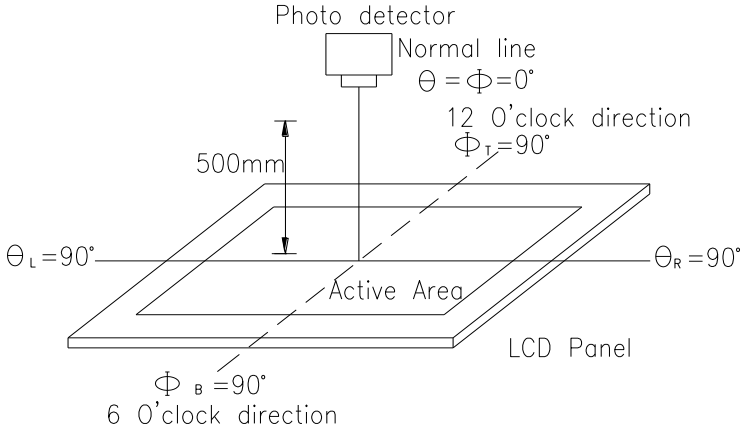
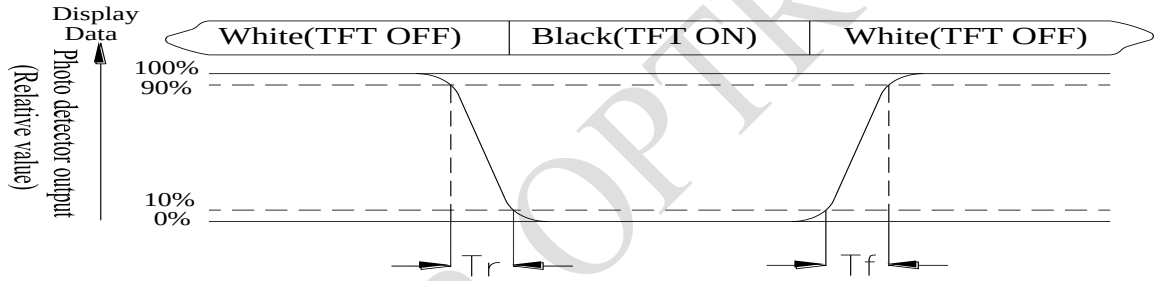


Fig. 11.2. Optical measurement system setup

Note 3: Definition of Response time:

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



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: Definition of Luminance Uniformity
Active area is divided into 9 measuring areas (reference the picture in below). Every measuring point is placed at the center of each measuring area.
Luminance Uniformity (U) = Lmin/Lmax x100%
L = Active area length
W = Active area width

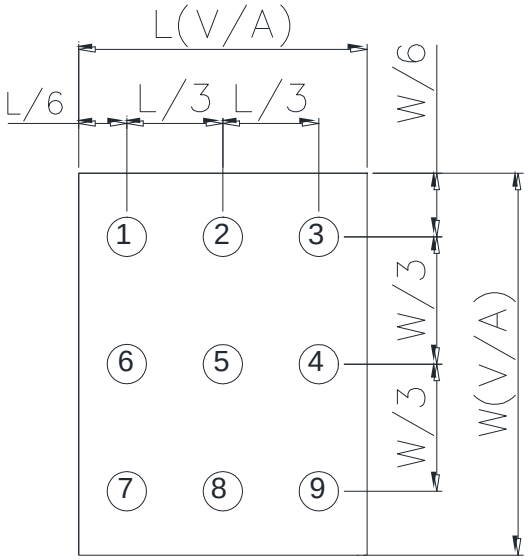


Fig11.3. . Definition of uniformity

Note 6: Definition of color chromaticity (CIE 1931)
Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

12.Reliability

Content of Reliability Test (Wide temperature, -20℃~70℃)

Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Note**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70℃ 200hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max	60℃,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20℃ 25℃ 70℃ 30min 5min 30min 1 cycle	-20℃/70℃ 10 cycles	——
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact) ,±800v(air), RS=330Ω CS=150pF 10 times	——

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

13.Initial Code For Reference

```
                GATE = 240;
        SOURCE = 320;

    IC_RST = 0;
    delay(100);
    asm("nop");
    asm("nop");
    asm("nop");
    IC_RST = 1;
    asm("nop");
    asm("nop");
    asm("nop");
    delay(1000);
    Write_Command(0x01);        //Software Reset
    Write_Command(0x01);
    Write_Command(0x01);
    asm("nop");
    asm("nop");
    asm("nop");
    asm("nop");
    delay(100);
    Command_Write(0xe0,0x01);       //START PLL
    delay(100);
    Command_Write(0xe0,0x03);       //LOCK PLL
    asm("nop");
    asm("nop");
    asm("nop");
    delay(100);


    //--Start Initial Sequence----------

    Write_Command(0x0028);    //VCOM OTP
    Write_Data16(0x0006);

    Write_Command(0x0000); //Oscilation star
    Write_Data16(0x0001);

    Write_Command(0x0010);    //Sleep mode
    Write_Data16(0x0000);

    Write_Command(0x0007);    //Display control
    Write_Data16(0x0033);

    Write_Command(0x0011);    //Enter mode
    Write_Data16(0x6230);     //(0x6230)
    //Write_Data16(0x6870);
```

```
        Write_Command(0x0016);    //Horizontal Porch
        Write_Data16(0xffff);     //(0x001d)
        Write_Command(0x0017);    //Vertical Porch
        Write_Data16(0xffff);     //(0x0003)

        Write_Command(0x0002);    //lcd driver
        Write_Data16(0x0600);

        Write_Command(0x0003);
        Write_Data16(0xaaae);
        //Write_Data16(0x4A38);

        Write_Command(0x0001);
        //Write_Data16(0x78ef);         //down to up
//      Write_Data16(0x72EF);       //up to down
        Write_Data16(0x32EF);       //up to down


//---*Power On sequence ------------------//
        Write_Command(0x000f);
        Write_Data16(0x0000);

        Write_Command(0x000b);
        Write_Data16(0x5208);
        //Write_Data16(0x5308);

        Write_Command(0x000c);
        Write_Data16(0x0005);
        //Write_Data16(0x0003);

        Write_Command(0x002a);
        Write_Data16(0x09d5);

        Write_Command(0x000d);
        Write_Data16(0x000d);
        //Write_Data16(0x0009);

        Write_Command(0x000e);
        Write_Data16(0x2400);
        //Write_Data16(0x2300);

        Write_Command(0x001e);
        Write_Data16(0x00ac);
        //Write_Data16(0x0010);

        Write_Command(0x0044);
        Write_Data16(0xef00);
```

```
        Write_Command(0x0045);
        Write_Data16(0x0000);

        Write_Command(0x0046);
        Write_Data16(0x013f);

        Write_Command(0x004e);
        Write_Data16(0x0000);

        Write_Command(0x004f);
        Write_Data16(0x0000);

//-------Gamma control---------------------//
        Write_Command(0x0030);
        Write_Data16(0x0100);

        Write_Command(0x0031);
        Write_Data16(0x0000);

        Write_Command(0x0032);
        Write_Data16(0x0106);

        Write_Command(0x0033);
        Write_Data16(0x0000);

        Write_Command(0x0034);
        Write_Data16(0x0000);

        Write_Command(0x0035);
        Write_Data16(0x0403);

        Write_Command(0x0036);
        Write_Data16(0x0000);

        Write_Command(0x0037);
        Write_Data16(0x0000);

        Write_Command(0x003a);
        Write_Data16(0x1100);

        Write_Command(0x003b);
        Write_Data16(0x0009);

        Write_Command(0x0025);
        Write_Data16(0xe000);

        Write_Command(0x0026);
```

```
Write_Data16(0x3800);
```

LCM Sample Estimate Feedback Sheet		
Module Number：_____		
1、Panel Specification：		
1. Panel Type：	□ Pass	□ NG ,_____
2. View Direction：	□ Pass	□ NG ,_____
3. Numbers of Dots：	□ Pass	□ NG ,_____
4. View Area：	□ Pass	□ NG ,_____
5. Active Area：	□ Pass	□ NG ,_____
6.Operating Temperature：	□ Pass	□ NG ,_____
7.Storage Temperature：	□ Pass	□ NG ,_____
8.Others：_____		
2、Mechanical Specification：		
1. PCB Size：	□ Pass	□ NG ,_____
2.Frame Size：	□ Pass	□ NG ,_____
3.Materal of Frame：	□ Pass	□ NG ,_____
4.Connector Position：	□ Pass	□ NG ,_____
5.Fix Hole Position：	□ Pass	□ NG ,_____
6.Backlight Position：	□ Pass	□ NG ,_____
7. Thickness of PCB：	□ Pass	□ NG ,_____
8. Height of Frame to PCB：	□ Pass	□ NG ,_____
9.Height of Module：	□ Pass	□ NG ,_____
10.Others：	□ Pass	□ NG ,_____
3、Relative Hole Size：		
1.Pitch of Connector：	□ Pass	□ NG ,_____
2.Hole size of Connector：	□ Pass	□ NG ,_____
3.Mounting Hole size：	□ Pass	□ NG ,_____
4.Mounting Hole Type：	□ Pass	□ NG ,_____
5.Others：	□ Pass	□ NG ,_____
4、Backlight Specification：		
1.B/L Type：	□ Pass	□ NG ,_____
2.B/L Color：	□ Pass	□ NG ,_____
3.B/L Driving Voltage (Reference for LED Type)：□ Pass □ NG ,_____		
4.B/L Driving Current：	□ Pass	□ NG ,_____
5.Brightness of B/L：	□ Pass	□ NG ,_____
6.B/L Solder Method：	□ Pass	□ NG ,_____
7.Others：	□ Pass	□ NG ,_____

>> **Go to page 2** <<

Module Number：_____

5、Electronic Characteristics of Module：

1.Input Voltage：	□ Pass	□ NG ,_____
2.Supply Current：	□ Pass	□ NG ,_____
3.Driving Voltage for LCD：	□ Pass	□ NG ,_____
4.Contrast for LCD：	□ Pass	□ NG ,_____
5.B/L Driving Method：	□ Pass	□ NG ,_____
6.Negative Voltage Output：	□ Pass	□ NG ,_____
7.Interface Function：	□ Pass	□ NG ,_____
8.LCD Uniformity：	□ Pass	□ NG ,_____
9.ESD test：	□ Pass	□ NG ,_____
10.Others：	□ Pass	□ NG ,_____

6、Summary：

Sales signature：_____

Customer Signature：_____ **Date**： / /