深圳市鸿光显示有限公司

SPECIFICATION
FOR
TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE :_____

HL MODEL : ___HG070WU039_____

□**Preliminary Specification**

■**Final Specification**

Customer Confirmation column：

 Approved by :_____Dept. :_____Data :_____

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Designed by	Checked by	Approved by

深圳市鸿光显示有限公司

Document Revision History

Version	Date	Page	Description	Changed By
A	2023-3-23	-	First issue	M

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1. LCM Specification

1.1 Description

HG070WU039 is a transmissive type color active matrix liquid crystal display(LCD) which uses amorphous thin film transistor(TFT) as switching devices. This product is composed of a TFT LCD panel, a drive IC, a FPC, and a LED-backlight unit. The active display area is 7.02（10：16） inches diagonally measured and the native resolution is WUXGA（1200*RGB*1920）.Features of this product are listed in the following table.

1.2 Functions & Features

Table 1.1 Module Functions & Features

Parameter	Value	Unit
LCD Mode	TFT/Transmissive	-
Color Depth	16.7M	-
Display Resolution	1200*RGB*1920	pixels
Module Size	161.66(L)*99.81 (W)*2.2 (T)(Exclude FPC)	mm
Active Area (A.A.)	151.2(L)* 94.5(W)	mm
Pixel Arrangement	RGB-stripe	-
Viewing Direction	ALL O'clock	
Display Mode	Normally white	
LCD Controller/Driver	TBD	-
IC Package Type	COG	-
Interface	MIPI	-
Backlight	White LED*20	pcs

2. Mechanical Specification

3. Pin Descriptions（参见 **P5** 页模组图）

Pin No.	Symbol	Description
1	NC	No connection
2	IOVCC	Power supply for system ,IOVCC=1.8V
3	IOVCC	
4	GND	Ground
5	RST	Device reset signal
6	NC	No connection
7	GND	Ground
8	MIPI_0N	MIPI Negative data signal (-)
9	MIPI_0P	MIPI Positive data signal (+)
10	GND	Ground
11	MIPI_1N	MIPI Negative data signal (-)
12	MIPI_1P	MIPI Positive data signal (+)
13	GND	Ground
14	MIPI_CKN	MIPI Negative clock signal (-)
15	MIPI_CKP	MIPI Positive clock signal (+)
16	GND	Ground
17	MIPI_2N	MIPI Negative data signal (-)
18	MIPI_2P	MIPI Positive data signal (+)
19	GND	Ground
20	MIPI_3N	MIPI Negative data signal (-)
21	MIPI_3P	MIPI Positive data signal (+)
22	GND	Ground
23	HS	Horizontal scan Signal for touch
24	VS	Vertical scan Signal for touch
25	GND	Ground
26	NC/TE	Tearing effect output signal for NVM(OTP),Let it open when not in use
27	PWMO	PWM control signal for LED driver (CABC)
28	NC/BIST	Enables the Test Image Generation function, if not used, connect to ground
29	NC	No connection
30	GND	Ground

31	LED-	LED cathode
32	LED-	
33	NC	No connection
34	VSN	Analog supply negative voltage
35	VSN	
36	NC	No connection
37	VSP	Analog supply positive voltage
38	VSP	
39	LED+	LED anode
40	LED+	

Note: Definition of scanning direction. Refer to the figure as below:

Top

Left

Right

AA size:7.02"
Resolution:1200(H)×RGB×1920(V)
Dot pitch:26.25um(H)×78.75um(V)

Down
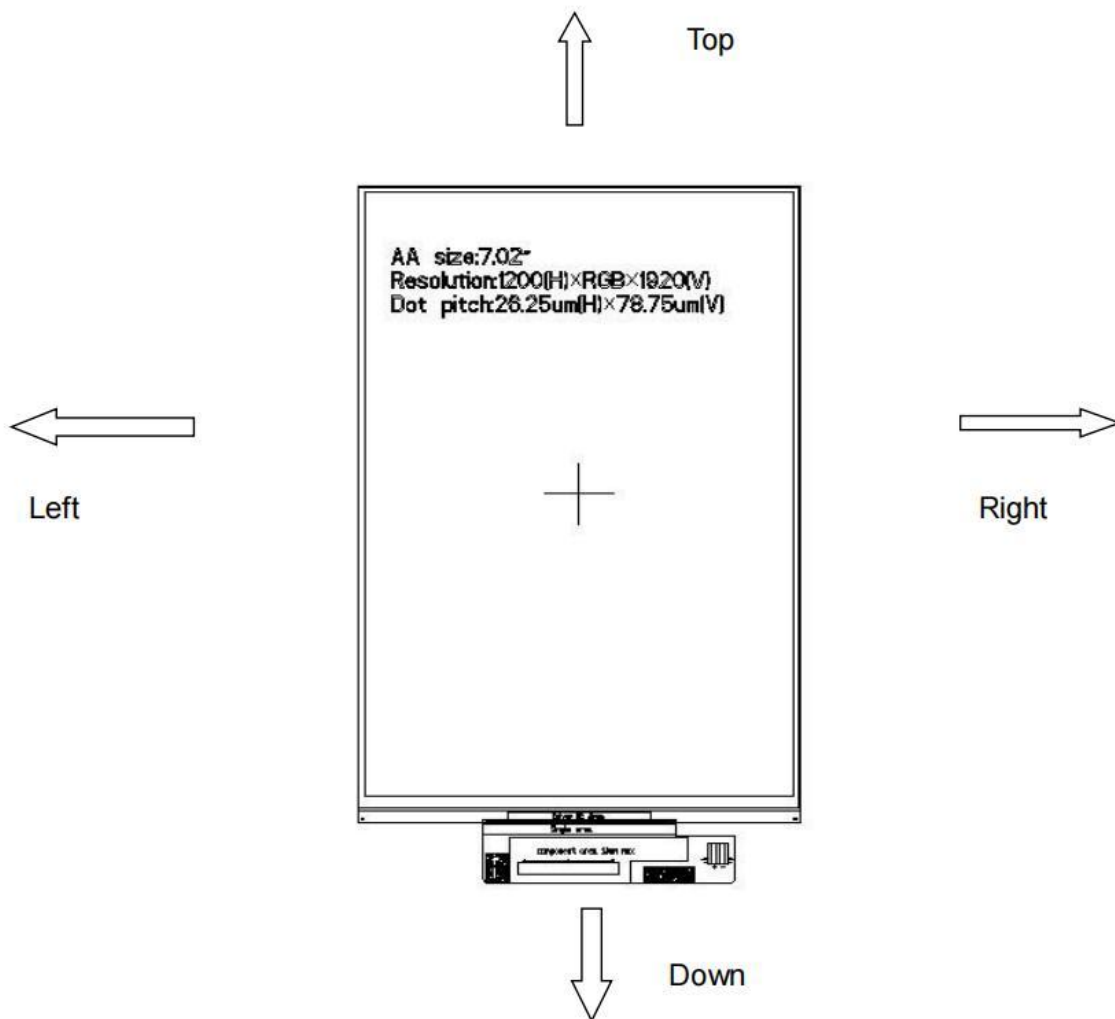
4. Electrical Units

4.1 Absolute Maximum Ratings

The absolute maximum ratings are list on Table 4.1. When used out of the absolute maximum ratings, the LCM may be permanently damaged. Using the LCM within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LCM will malfunction and cause poor reliability.

Table 4.1　Module Absolute Maximum Ratings

(GND=AVss=0V,Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	IOVCC	0	4.6	V	
	VSP	0	6.5	V	
	VSN	-6.5	0	V	
Operation Temperature Storage Temperature	T_{OP}	-20	70	℃	
	T_{ST}	-30	80	℃	

Note : The absolute maximum ratings are the values that must not be exceeded at any time for this product. It is not allowed for any of these ratings to be exceeded. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed. Therefore, when designing a system incorporating the module, make sure that adequate attentions be paid to the variations in the supply   voltages, the characteristics of parts that are connected, surges in the input and output lines, and the   ambient temperatures.

4.2 Typical Operation Conditions

4.2.1. DC Characteristics

(Ta=25°C)

| Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Power supply voltage for Analog		VSP	5.3	5.5	5.7	V	
		VSN	-5.7	-5.5	-5.3	V	
Power supply voltage for Logic		IOVCC	1.70	1.80	1.90	V	
Input signal voltage (RES)		V_{IL}	0	-	0.3*IOVCC	V	XRES
		V_{IH}	0.7*IOVCC	-	IOVCC	V	
Output signal voltage (TE)		V_{OL}	0	-	0.2*IOVCC	V	TE
		V_{OH}	0.8*IOVCC	-	IOVCC	V	
Input signal voltage (DSI)	Low level	$V_{IL(DSI)}$	-50	-	550	mV	Low Power Receiver
	High level	$V_{IH(DSI)}$	880	-	1350	mV	
	Input voltage	V_{CMRX}	70	-	330	mV	High Speed Receiver
	Differential input low threshold	V_{IDTL}	-70	-	-	mV	
	Differential input high threshold	V_{IDTH}	-	-	70	mV	

Note 1) The recommended operating conditions refers to a range in which operation of this product is guaranteed. Should this range is exceeded, the operation cannot be guaranteed even if the values may be withing the absolute maximum ratings. Accordingly, please make sure that the module is used within this range.

4.2.2. Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	IOVCC	.	12	24	mA	White Pattern
	VSP	.	10	13	mA	
	VSN	.	10	13	mA	

4.2.3. Power Sequence
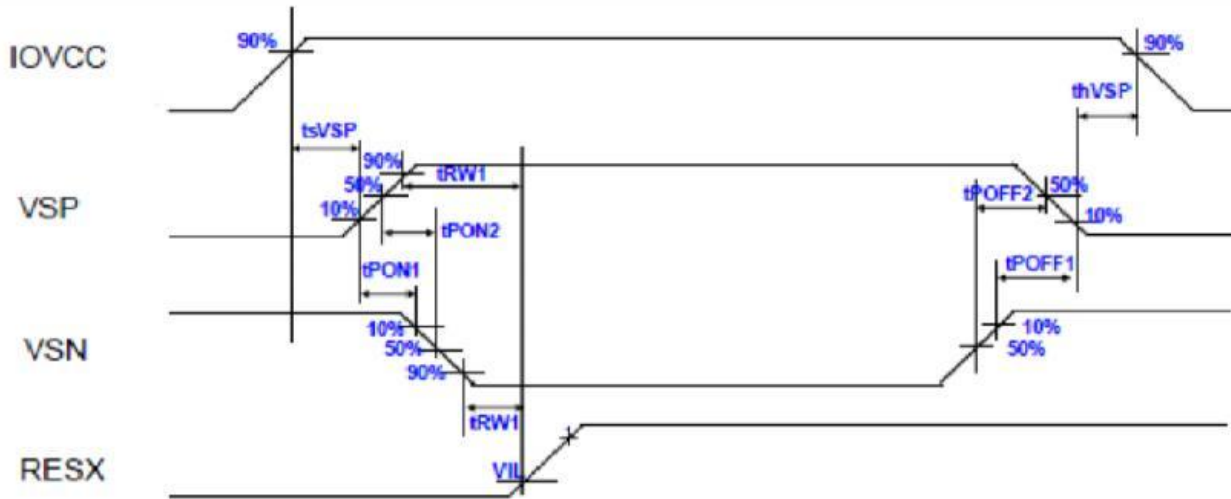
Item	Symbol	Unit	Min	Max
IOVCC on to VSP on time	tsVSP	ms	1	-
VSP on to VSN on time	tPON1	ms	0	-
VSN on to REST on time	tRW1	ms	1	-
VSN off to VSP off time	tPOFF1	ms	0	-
VSP off to IOVCC off time	thVSP	ms	0	-

4.3. Command sequence

4.3.1 Status Flow

(1200RGBx1920, R69429, MIPI 4lane)
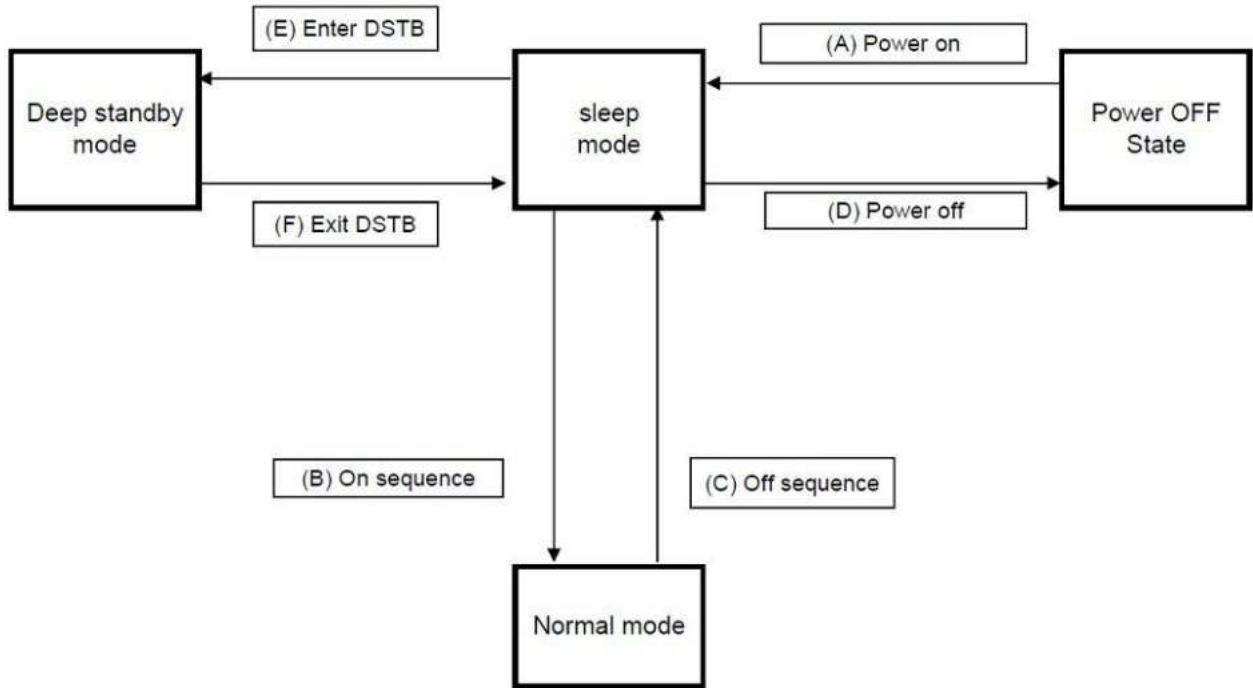
4.3.2 Sequence

(A) Power on

sequence	DataType (hex)	index (hex)	parameters # (hex)	description	comment
POWER OFF STATE					
PWR supply on				IOVCC on	DSI input should be at GND level while IOVCC off
wait 5ms					
PWR supply on				VSP,VSN on	
wait 20ms					
RESET L->H				RESET L->H	
wait 10ms					
PWR supply off				VSP,VSN off	(*1)Can skip "VSP/VSN off" in case of going to normal mode without staying sleep status.
(wait 20ms)					
SLEEP MODE					

(B) On sequence

sequence	DataType (hex)	index (hex)	parameters #	(hex)	description	comment
SLEEP MODE						
PWR supply on					VSP,VSN on	
wait 20ms						
command	05	01	-	-	soft reset	
wait 10ms						
command	23	B0	1	00	MCAP	
command	29	B3	1	14	Interface setting	
			2	08		
			3	00		
			4	22		
			5	00		
command	29	B4	1	0C	Interface ID setting	
command	29	B6	1	3A	DSI control	
			2	D3		
command	15	51	1	E6-	write display brightness	
command	15	53	1	2C	write control display	
command	05	29	-	-	set display on	
wait 10ms						
command	05	11	-	-	exit sleep mode	
Wait 120ms						
NORMAL MODE						

(C) Off sequence

sequence	DataType (hex)	index (hex)	parameters # (hex)		description	comment
NORMAL MODE						
command	05	28	-	-	set display off	
wait 20ms						
command	05	10	-	-	enter sleep mode	
wait 80ms						
stop HS transmission						
PWR supply off					VSP,VSN off	
wait 20ms						
SLEEP MODE						

(D) Power off

sequence	DataType (hex)	index (hex)	parameters # (hex)		description	comment
SLEEP MODE						
RESET H->L						
PWR supply off					IOVCC off	DSI data/clk should be at GND level after IOVCC off.
POWER OFF STATE						

(E) Enter DSTB

sequence	DataType (hex)	index (hex)	parameters # (hex)		description	comment
SLEEP MODE						
command	23	B0	1	00	MCAP	
command	23	B1	1	01	DSTB=1	
DSTB MODE						

(F) Exit DSTB

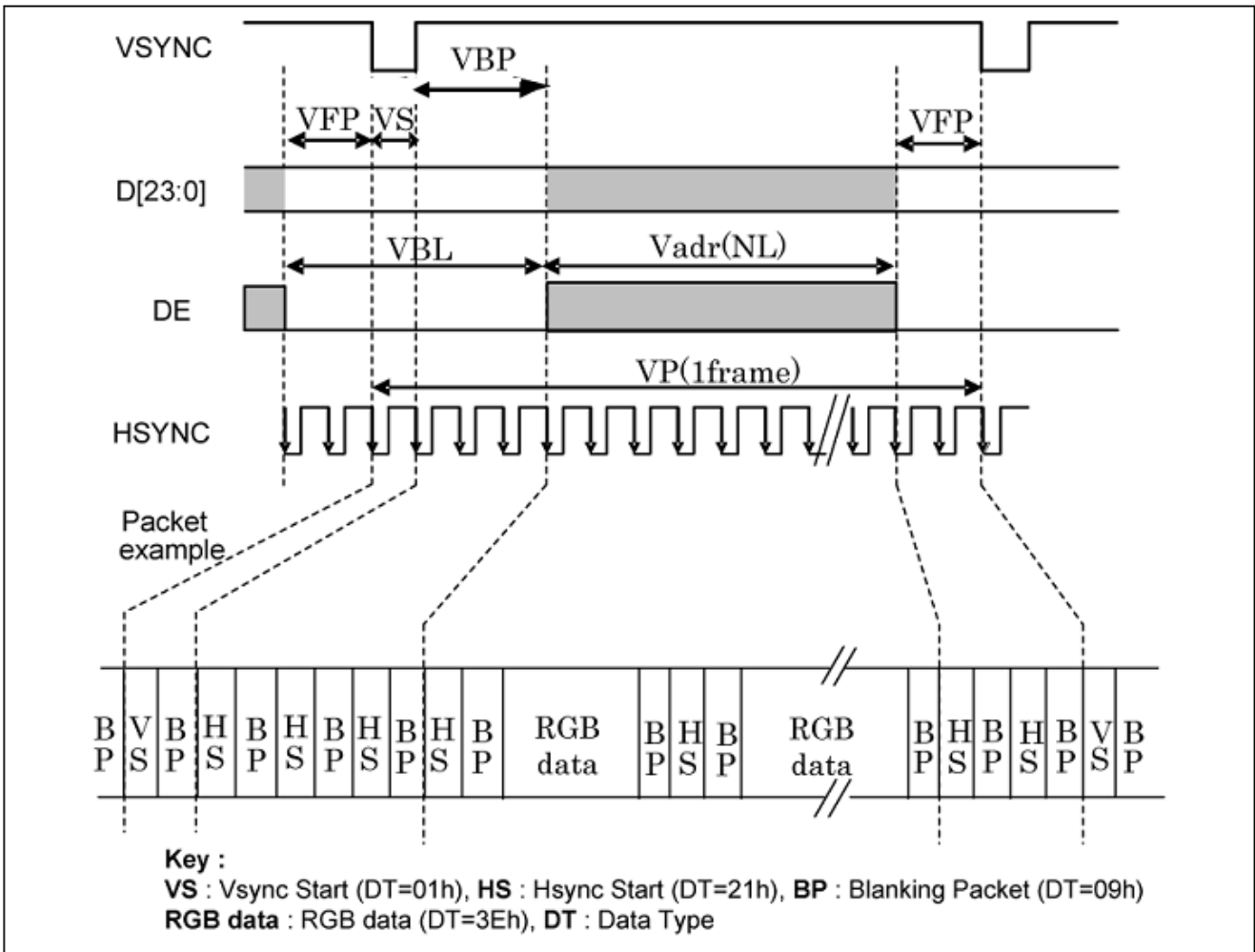| sequence	DataType (hex)	index (hex)	parameters # (hex)		description	comment
DSTB MODE						
RESET H -> L						
wait 10ms						
PWR supply on					VSP,VSN on	
wait 20ms						
RESET L->H					RESET L->H	
wait 10ms						
PWR supply off					VSP,VSN off	(*1)Can skip "VSP/VSN off" in case of going to normal mode without staying sleep status.
(wait 20ms)						
SLEEP MODE						

4.4. Display Timing (Video Mode)

Transmission packet sequence in video mode	RSP LCD driver implementation
Non-burst mode with sync pulses	Not supported
Non-burst mode with sync events	Supported
Burst mode	Supported

Vertical Display Timing

Key :
VS : Vsync Start (DT=01h), HS : Hsync Start (DT=21h), BP : Blanking Packet (DT=09h)
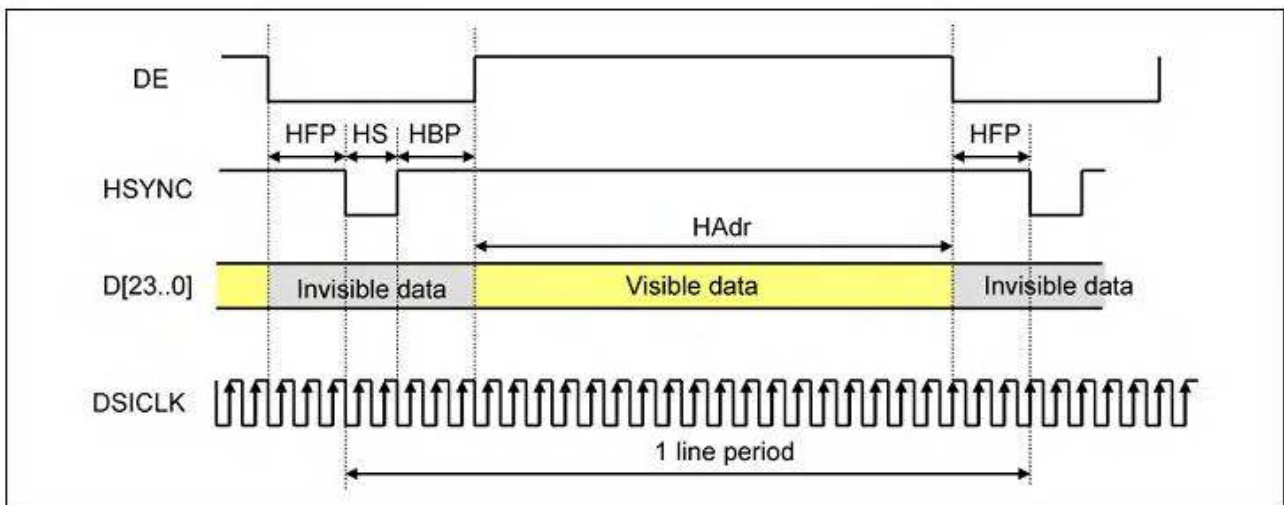RGB data : RGB data (DT=3Eh), DT : Data Type
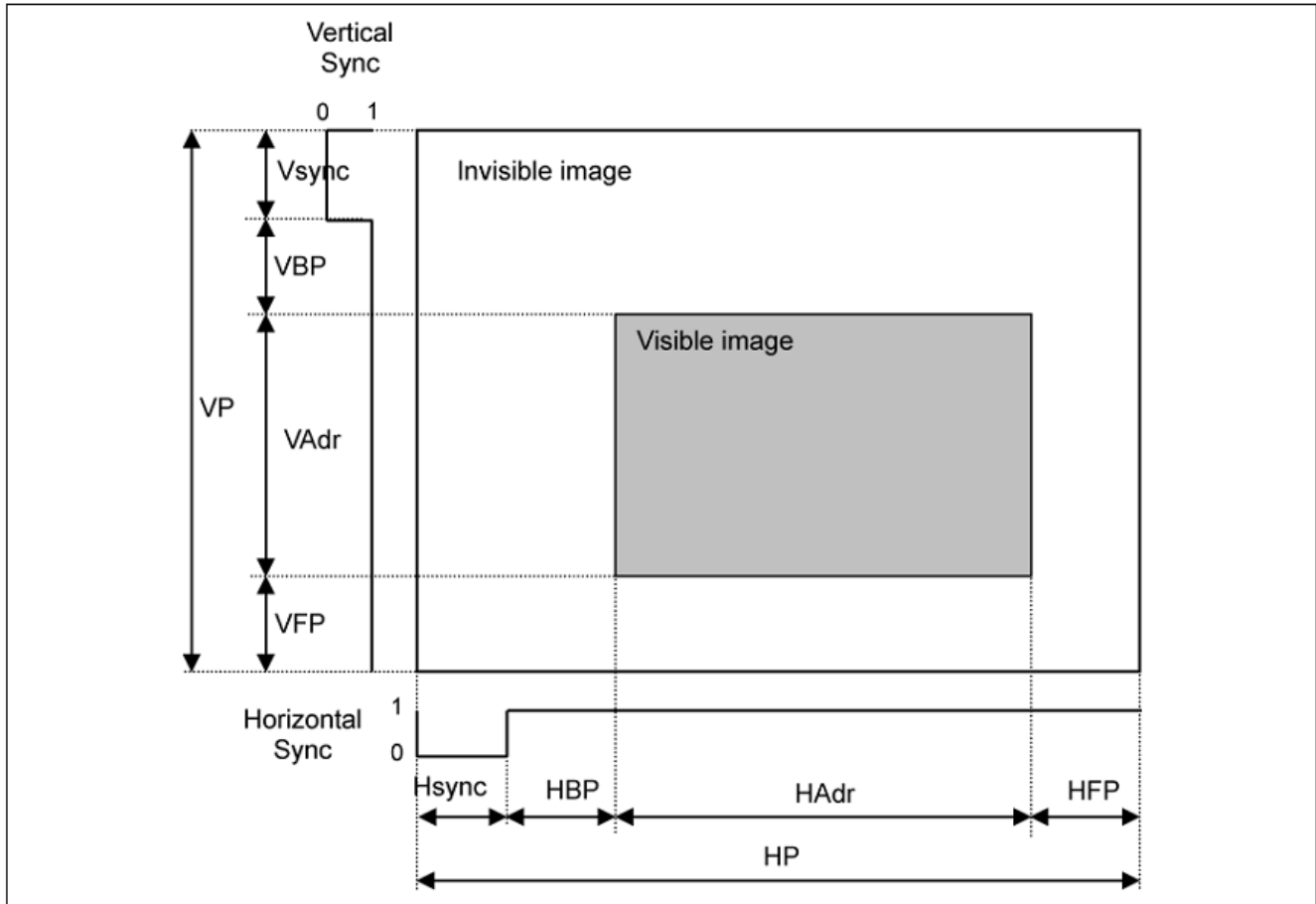
Horizontal Display Timing

Vertical Display Timing (Video Mode, RM = 1h, DM = 3h, Method-1)

Item	Symbol	Condition	Unit	Min.	Typ.	Max.	Notes
Vertical cycle	VP		Line	1448	1928	1928	
Vertical low pulse width	VS		Line	1	1	-	See
Vertical front porch	VFP		Line	4	-	-	
Vertical back porch	VBP		Line	4	-	BP-3	See
Vertical data start point	-	VS+VBP	Line	5	-	BP-4	See
Vertical blanking period	VBL	VBP+VFP	Line	8	-	-	
Vertical active area	Vadr		Line	1440	1920	1920	

Note: "VS + VBP" is set as back porch by BP register.

1 line : prescribed by HSYNC (when RM = 2'h0, DM = 4'h1)

prescribed by RTN setting (whenRM = 2'h1, DM = 4'h3)

BP : register setting

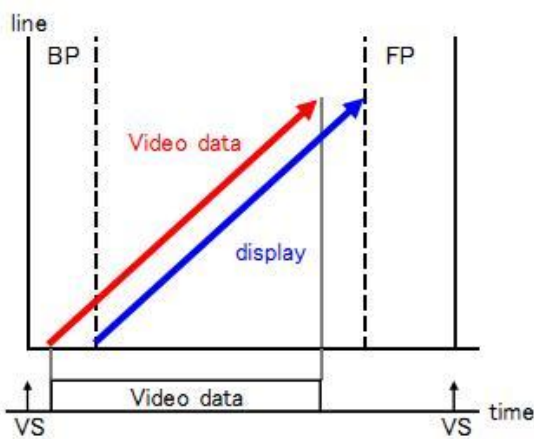## Vertical Display Timing (Video Mode, RM = 1h, DM = 3h, Method-2)

Item	Symbol	Condition	Unit	Min.	Typ.	Max.	Notes
Vertical cycle	VP		Line	1448	1928	1928	
Vertical low pulse width	VS		Line	1	1	-	See
Vertical front porch	VFP		Line	4	-	-	
Vertical back porch	VBP		Line	BP+3	-	-	See
Vertical data start point	-	VS+VBP	Line	BP+4	-	-	See
Vertical blanking period	VBL	VBP+VFP	Line	BP+7	-	-	See
Vertical active area	Vadr		Line	1440	1920	1920	

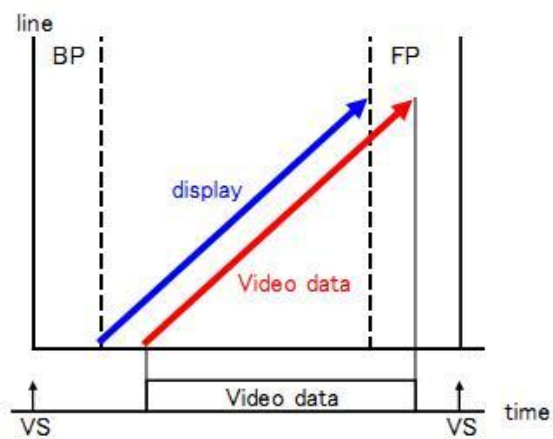Note: "VS + VBP" is set as back porch by BP register.

1 line : prescribed by HSYNC (when RM = 2'h0, DM = 4'h1)

prescribed by RTN setting (whenRM = 2'h1, DM = 4'h3)

BP : register setting

Method - 1   Method - 2

Horizontal Display Timing (Video Mode, RM = 1h, DM = 3h)

Item	Symbol	Condition	Unit	Min.	Typ.	Max.	Notes
Horizontal front porch	HFP		ByteClock	4lane:100+β	-	-	
Horizontal data start point	-	HS+HBP	ByteClock	45+α	-	-	
Horizontal active area	Hadr		Pixel	1080 -	- 1280	1200 -	1Chip 2Chip

Note: fByteClock = (1/4) * fDSICLK. fByteClock = frequency of ByteClock.

α, β ≦ 45 ByteClock

Please refer to the following restrictions about α, β.

Vertical Display Timing (Video Mode, DM = 1h)

Item	Symbol	Condition	Unit	Min.	Typ.	Max.	Notes
Vertical cycle	VP		Line	1448	1928	-	
Vertical low pulse width	VS		Line	1	1	-	See
Vertical front porch	VFP		Line	4	-	-	
Vertical back porch	VBP		Line	4	-	-	See
Vertical data start point	-	VS+VBP	Line	5	-	-	
Vertical blanking period	VBL	VBP+VFP	Line	8	-	-	
Vertical active area	Vadr		Line	1440	1920	-	

Note: "VS + VBP" is set as back porch by BP register.

1 line : prescribed by HSYNC (when RM = 2'h0, DM = 4'h1)

prescribed by RTN setting (when RM = 2'h1, DM = 4'h3)

Horizontal Display Timing (Video Mode, RM = 0h, DM = 1h)

Item	Symbol	Condition	Unit	Min.	Typ.	Max.	Notes
Horizontal front porch	HFP		ByteClock	4lane:100+β	-	-	
Horizontal data start point	-	HS+HBP	ByteClock	45+α	-	-	
Horizontal active area	Hadr		Pixel	1080 -	- 1280	1200 -	1Chip 2Chip

Note: fByteClock = (1/4) * fDSICLK. fByteClock = frequency of ByteClock.

α, β ≦ 45 ByteClock

Please refer to the following restrictions about α, β.

5. OPTICAL CHARACTERISTICS

$(T_a = +25℃)$

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	Φ=180°(9 o'clock)	-	80	-	degree	Note 1 Note 5
	θ_R	Φ=0°(3 o'clock)	-	80	-		
	θ_T	Φ=90°(12 o'clock)	-	80	-		
	θ_B	Φ=270°(6 o'clock)	-	80	-		
Response time	T_{ON+} T_{OFF}	Normal θ=Φ=0°		25		msec	Note 2 Note 3
Contrast ratio	CR			1200	-	-	Note 4 Note 5
Color chromaticity	W_X		-	0.31	-	-	Note 5
	W_Y		-	0.33	-	-	
Transmittance	Tr	-	-	3.8	-	%	Note 5
NTSC Ratio				71.5		%	Note 5

Test Conditions:

VCC=1.8V, the ambient temperature is 25℃.

The test systems refer to Note 2.
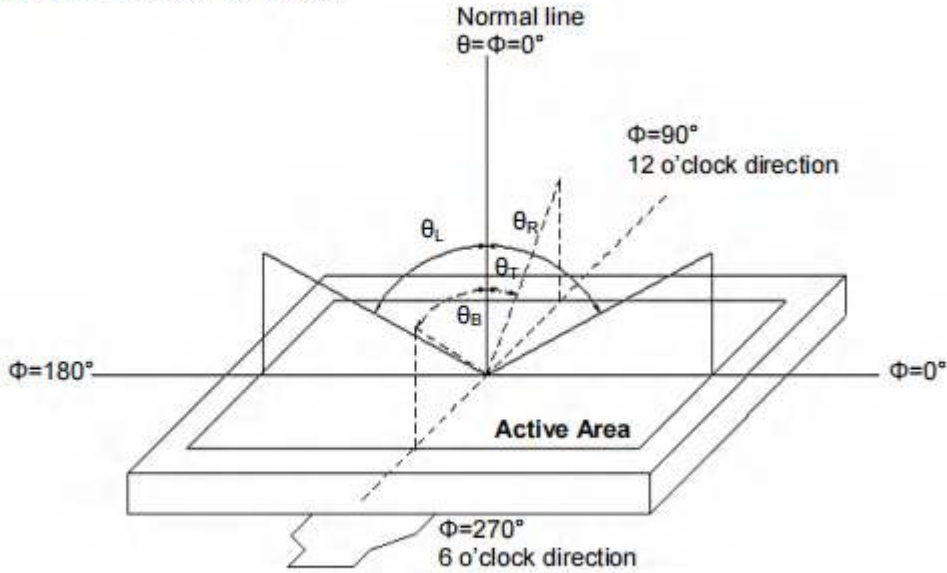
Note 1: Definition of viewing angle range

Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.
The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm, Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/ Field of view: 1° /Height: 500mm.)
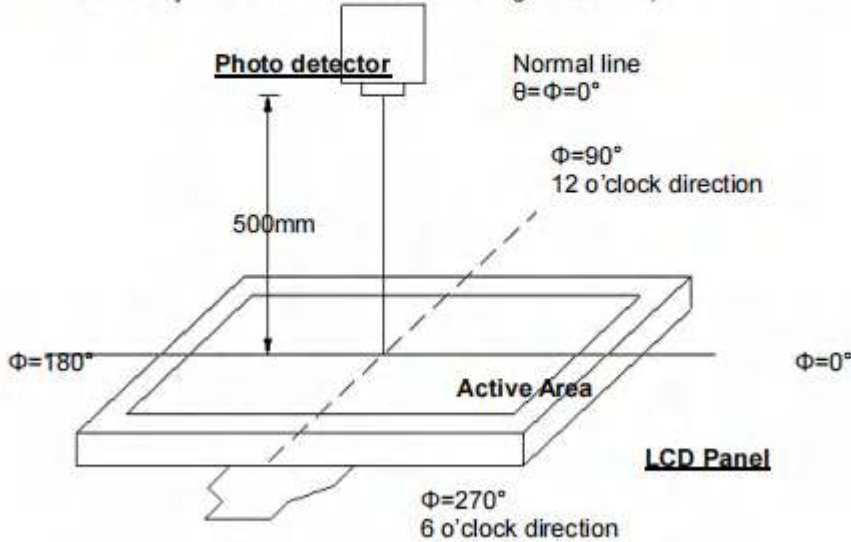
Fig. 4-2 Optical measurement system setup

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 (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.
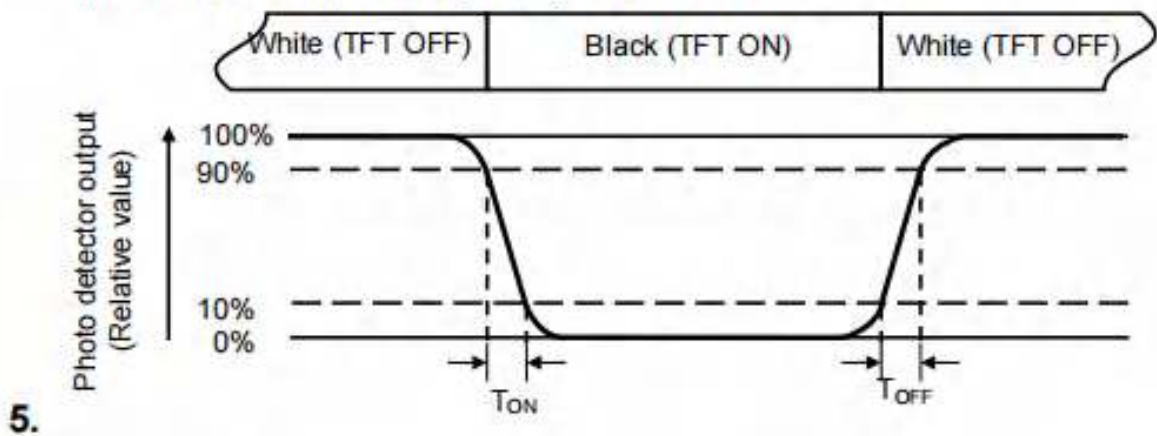
5.

Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of backlight

The data is measured by using TDI's backlight system.

6. Reliability Tests / Environmental

No	Test Item	Test Condition	STANDARD
1	High Temperature Storage	+80°C / 96Hours	1. Functional test is OK. Missing Segment, short, unclear segment, on-display, display abnormally and liquid crystal leak are un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temperature Storage	-30°C / 96Hours	
3	High Temperature Operating	+70°C / 96Hours	
4	Low Temperature Operating	-20°C / 96Hours	
5	Thermal and cold shock	0°C⇆+50°C x 10cycles (30min) (5min) (30min)	
6	Operate at High Temperature and Humidity	60°C x 90%RH / 24H	
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude:1.5mm, 2 hours for each direction of X, Y, Z	1. Function test is OK. 2. No glass crack, chipped glass, end seal loose and fall, epoxy frame crack and so on. 3. No structure loose and fall.
8	Dropping test	Drop to the ground from 1m height, 1 corner, 3 edges, 6 surfaces.	
9	ESD test	Contact: ±6KV Air: ±10KV 150PF/330Ω,5Points/panel,5times	The test results shall be subject to the whole machine test.

NOTE：
1. The reliability items will be fully performed in new sample qualification,
2. The reliability status will be tested as monitor during mass production. Individual reliability test shall be performed by lot , Moreover, the individual reliability item shall be decided according to
reliability plan.
3. All samples are inspected after keeping in the room with normal temperature and humidity for
2 hours or above.
4. Vibration test: It is not necessary to test for those products without assembly frame , backlight , PCB and so on.
5. Dropping test : It is necessary for affirming new package.
6. For the high temperature and high humidity test, pure water of over 10 MΩ.cm should be used.
7. Each test item applies for test LCM only once . Then tested LCM cannot be used again in anyother test item.
8. The quantity of LCM examination for each test item is 5pcs to 10pcs.

7. Backlight Specification

Table 4.3 Back-light Characteristics

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	VF	Only Backlight	27.5	30	32.5	V
Supply Current	IF			93.5		mA
Average Brightness (With LCD dots all on)	IV	Backlight Current IF=20mA	799	800	-	Cd/m2
CIE Color Coordinate (Without LCD)	X	Backlight Current IF=20mA	0.25	–	0.30	–
	Y		0.25	–	0.30	
Uniformity	B	Backlight Current IF=20mA	80	–	–	%
Color	White					

Note: With 20 pcs white LED parallel connection.

7. Handling Precautions

a. Safety

i. The liquid crystal in the LCD is poisonous. DO NOT put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

b. Handling

i. The LCD and touch panel is made of plate glass. DO NOT subject the panel to mechanical shock or to excessive force on its surface.

ii. Do not handle the product by holding the flexible pattern portion in order to assure the reliability

iii. Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.

iv. Provide a space so that the panel does not come into contact with other components.

v. To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.

vi. Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.

vii. Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.

viii. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

ix.

c. Static Electricity

i. Ground soldering iron tips, tools and testers when they are in operation.

ii. Ground your body when handling the products.

iii. Power on the LCD module BEFORE applying the voltage to the input terminals.

iv. DO NOT apply voltage which exceeds the absolute maximum rating.

v. Store the products in an anti-electrostatic bag or container.

vi.

d. Storage

i. Store the products in a dark place at +25℃±10℃ with low humidity (65%RH or less).

ii. DO NOT store the products in an atmosphere containing organic solvents or corrosive gas.

iii.

e. Cleaning

i. DO NOT wipe the touch panel with dry cloth, as it may cause scratch.

ii. Wipe off the stain on the product by using soft cloth moistened with ethanol. DO Not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

9. Package Specification

TBD