TO : 聯濤

Date : 2022/5/25

HannStar Product Information

(Preliminary)

3.97” Color TFT-LCD Module

Model: HSD040G8W9

-90000A-PX

Note: (1) The information contained herein is tentative and may be changed without prior notices.

(2) Please contact HannStar Display Corp. before designing your product based on this module specification.

(3) The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by HannStar for any intellectual property claims or other problems that may result from application based on the module described herein.

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1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD040G8W9-90000A-PX is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a back- light system. This TFT LCD has a 3.97 (15:9) inch diagonally measured active display area with WVGA (480 horizontal by 800 vertical pixel) resolution.

1.2 Features

- 3.97 inch configuration
- 65K color by 16 bits R.G.B.
- ROHS / Halogen Free Compliance

1.3 General information

Item		Specification	Unit
Outline Dimension(LCM)		57.14(H) x 96.85(V) x2.20(D)	mm
Display area		51.84 (H) x 86.40 (V)	mm
Number of Pixel		480 RGB (H) x 800 (V)	pixels
Pixel pitch		0.108 (H) x 0.108 (V)	mm
Pixel arrangement		RGB Vertical Stripe	--
Display mode		Normally White	--
Display Interface		16 bit RGB	--
NTSC		60 (Typ.)	%
Surface treatment		HC	--
Weight		25.4	g
Power Consumption	Logic System (White Pattern)	0.0818 (typ.)	W
	B/L System	0.48 (typ.)	W

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2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Analog Supply voltage	VCI	-0.3	3.6	V	GND=0
Digital supply voltage	IOVCC	-0.3	3.6	V	GND=0
Logic Input voltage	Vin	-0.3	IOVCC+0.5	V	GND=0

Note (1):

Permanent damage may occur to the LCD module if beyond this specification.

Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2):

Ta =25±2℃

2.2 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-20	70	℃	(3),(4)
Storage Temperature	T_{stg}	-30	80	℃	(3),(4)

Note (3):

If Ta below 50ºC, the maximal humidity is 90%RH, if Ta over 50ºC, absolute humidity should be less than 60%RH.

Note (4):

The response time will be extremely slow when the operating temperature is around -10℃, and the back ground will become darker at high temperature operating.

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3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 Normal viewing angle	560	700	--	--	(1)(2)
Response time		Tr+Tf		--	16	32	msec	(1)(3)
White luminance (Center)		Y_L		260	300	--	cd/m^2	(1)(4)
Color Gamut		S(%)		--	60	--	%	
Color chromaticity (CIE1931)	White	W_x		0.25	0.29	0.33		(1)(4)
		W_y		0.28	0.32	0.36		
	Red	R_x		--	--	--		
		R_y		--	--	--		
	Green	G_x		--	--	--		
		G_y		--	--	--		
	Blue	B_x		--	--	--		
		B_y		--	--	--		
Viewing angle	Hor.	$Θ_L$	CR>10	--	70	--		
		$Θ_R$		--	70	--		
	Ver.	$Θ_U$		--	70	--		
		$Θ_D$		--	60	--		
Brightness Uniformity		B_{UNI}	Θ=0	80	--	--		(5)
Optima View Direction		12 o'clock						

3.2 Measuring Condition

- ■ Measuring surrounding：dark room
- ■ Ambient temperature：25±2°C
- ■ 15min. warm-up time.

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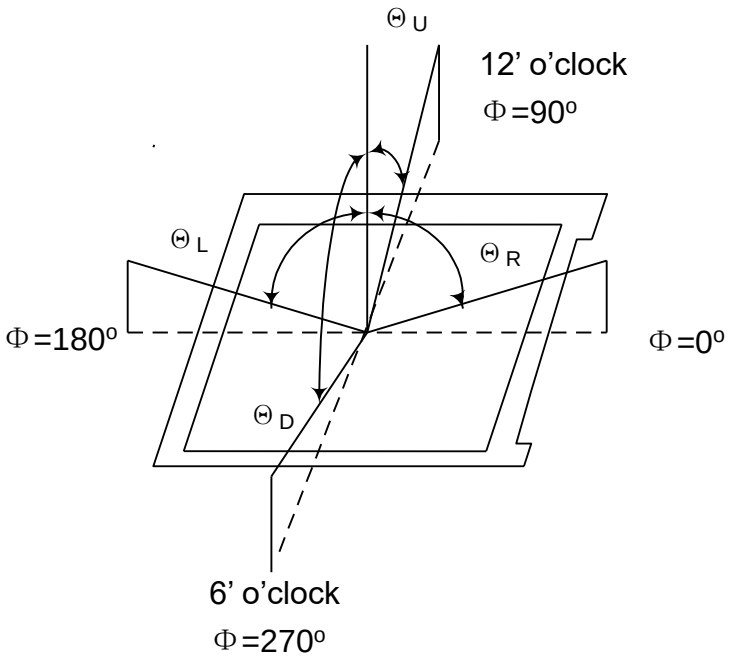
3.3 Measuring Equipment

■ FPM520 of Westar Display technologies, INC., which utilized KONICA MINOLTA CA-320 for Chromaticity and TOPCON BM-7A for other optical characteristics.

■ Measuring spot size: 20 ~ 21 mm

Note (1) Definition of Viewing Angle:



Note (2) Definition of Contrast Ratio (CR) :

measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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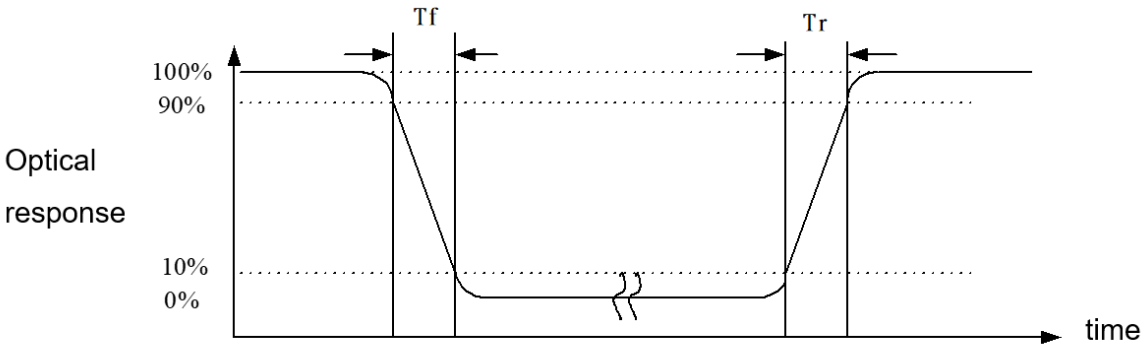
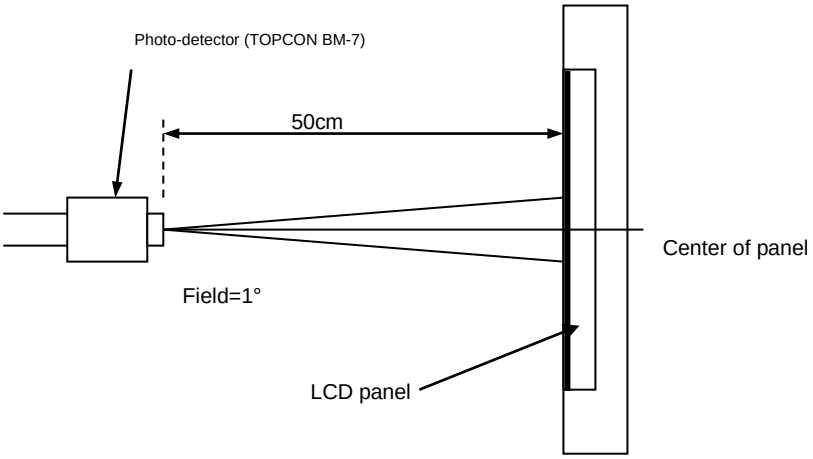
Note (3) Definition of Response Time : Sum of Tr and Tf



Note (4) Definition of optical measurement setup



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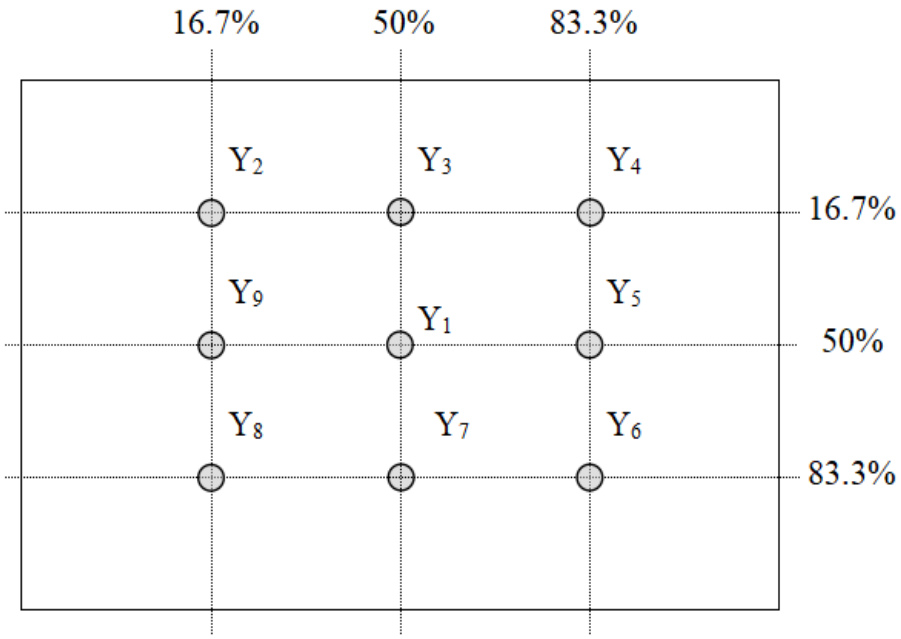
Note (5) Definition of brightness uniformity



$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 5 points(Y2、Y4、Y6、Y8、Y1))}}{\text{(Max Luminance of 5 points(Y2、Y4、Y6、Y8、Y1))}} \times 100\%$$

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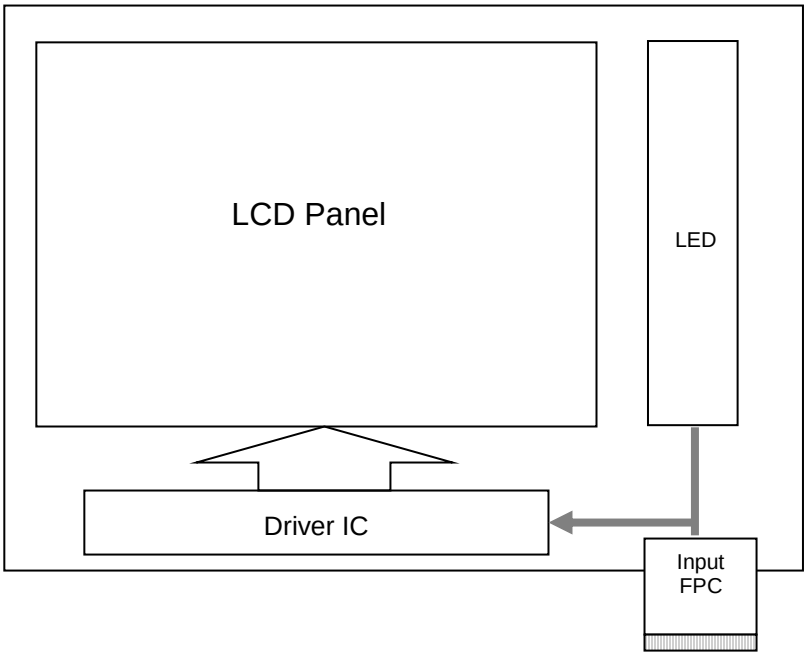
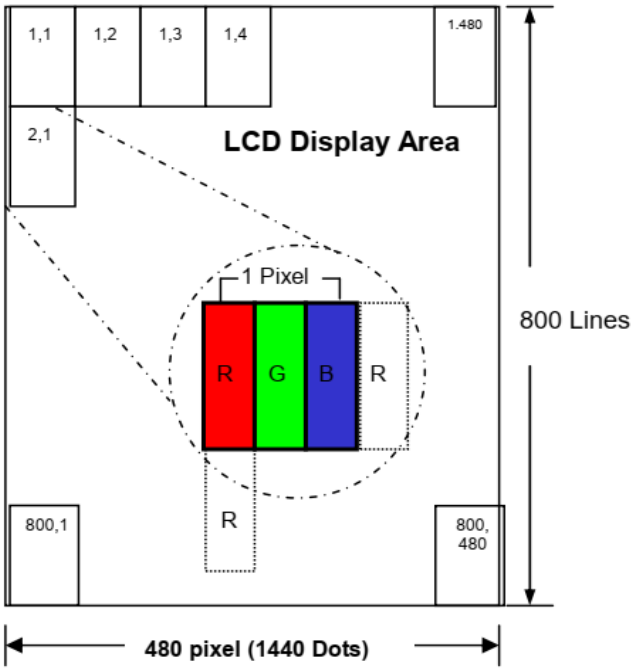
4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.1 Pixel Format



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5.0 INTERFACE PIN CONNECTION

5.1 LCM Pin Assignment

The recommended connector：FHB5C-31S manufactured by HIROSE

PIN NO.	Symbol	Level	Description
1	VS	I	Vertical sync signal
2	HS	I	Horizontal sync signal
3	DE	I	Data enable
4	DCLK	I	Pixel clock
5	GND	GND	Power ground
6	SDI	I	Serial data input
7	SDO	I	Serial data output pin used for the SPI Interface
8	SCLK	I	Serial clock input
9	CS	I	chip select signal
10	RESET	I	Reset signal pin
11-15	R4-R0	I	Red data
16-21	G5-G0	I	Green data
22-26	B4-B0	I	Blue data
27	GND	GND	Power ground
28	VDD	P	Power voltage
29	VDDIO1.8V	P	Power voltage
30	LEDA	--	Power for LED backlight anode
31	LEDK	--	Power for LED backlight cathode

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6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Analog Supply voltage	VCC	2.5	2.8	3.3	V	
Analog supply current	I_{VCC}	-	26	39	mA	VCC=2.8V
Logic supply voltage	IOVCC	1.65	1.8	3.3	V	
Logic supply current	I_{IOVCC}	3	5	-	mA	IOVCC =1.8V
Logic input voltage	VIH	0.7*IOVCC	-	IOVCC	V	
	VIL	-0.3	-	0.3*IOVCC	V	

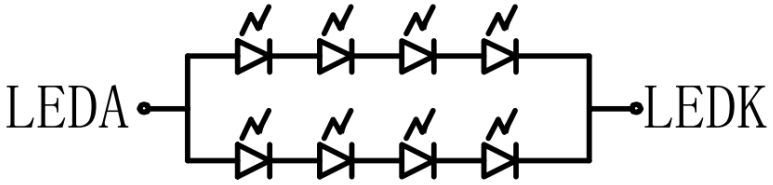
6.2 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Current	I_F	--	40	--	mA	Ta=25℃
LED Voltage	V_F	11.6	12	13.2	Volt	Ta=25℃
LED Life-Time	N/A	20,000	--	--	Hour	Ta=25℃ Note (2)

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ºC, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃. and LED typical current. The LED lifetime could be decreased if operating I_F is larger than LED typical current. The constant current driving method is suggested.

Note (3) LED light bar circuit :



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6.3 Interface Characteristics

6.3.1 AC characteristics for interface

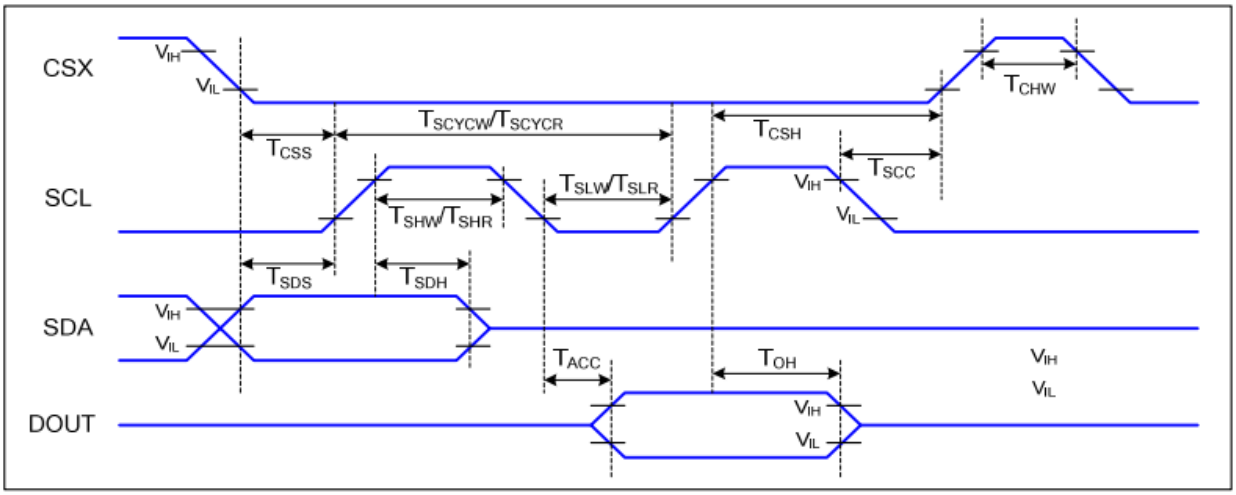

Figure 1 3-line serial Interface Timing Characteristics

VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	60		ns	
	T_{CHW}	Chip select “H” pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL “H” pulse width (Write)	15		ns	
	T_{SLW}	SCL “L” pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL “H” pulse width (Read)	60		ns	
	T_{SLR}	SCL “L” pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	

Table 4 3-line serial Interface Characteristics

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6.3.2 RGB Interface Characteristics

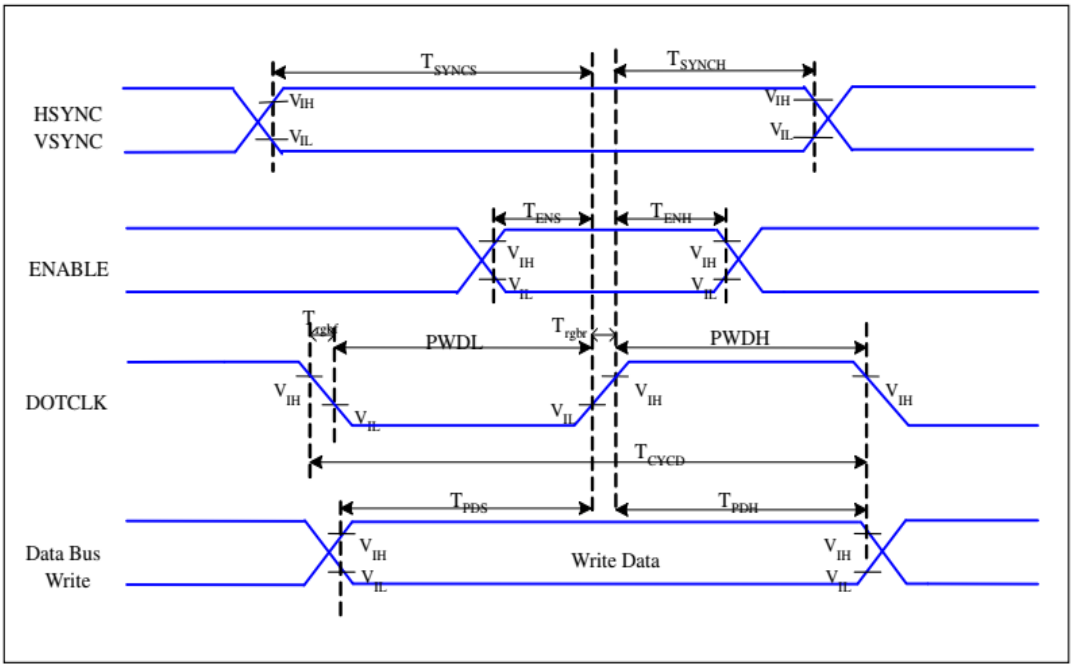

Figure 3 RGB Interface Timing Characteristics

VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	5	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	5	-	ns	
	T_{ENH}	Enable Hold Time	5	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	15	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	15	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	33	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	15	ns	
DB	T_{PDS}	PD Data Setup Time	5	-	ns	
	T_{PDH}	PD Data Hold Time	5	-	ns	

Table 6 18/16 Bits RGB Interface Timing Characteristics

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6.3.3 RGB Interface TIMING

The display operation via the RGB interface is synchronized with the VSYNC, HSYNC, and DOTCLK signals. The data can be written only within the specified area with low power consumption by using window address function. The back porch and front porch are used to set the RGB interface timing.

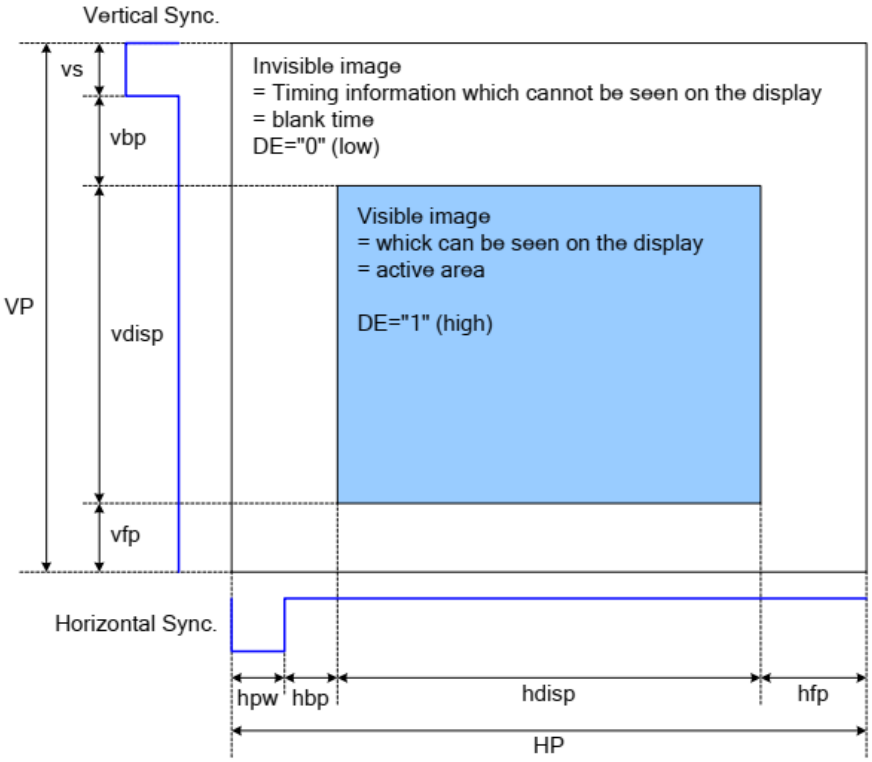

Figure 22 Access Area by RGB Interface

Please refer to the following table for the setting limitation of RGB interface signals.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	1	-	255	Clock
Horizontal Sync. Back Porch	hbp	1	--	255	Clock
Horizontal Sync. Front Porch	hfp	1	--	-	Clock
Vertical Sync. Width	vs	1	--	254	Line
Vertical Sync. Back Porch	vbp	1	--	254	Line
Vertical Sync. Front Porch	vfp	2	--	--	Line

Note:

1. *Typical value are related to the setting frame rate is 60Hz..*

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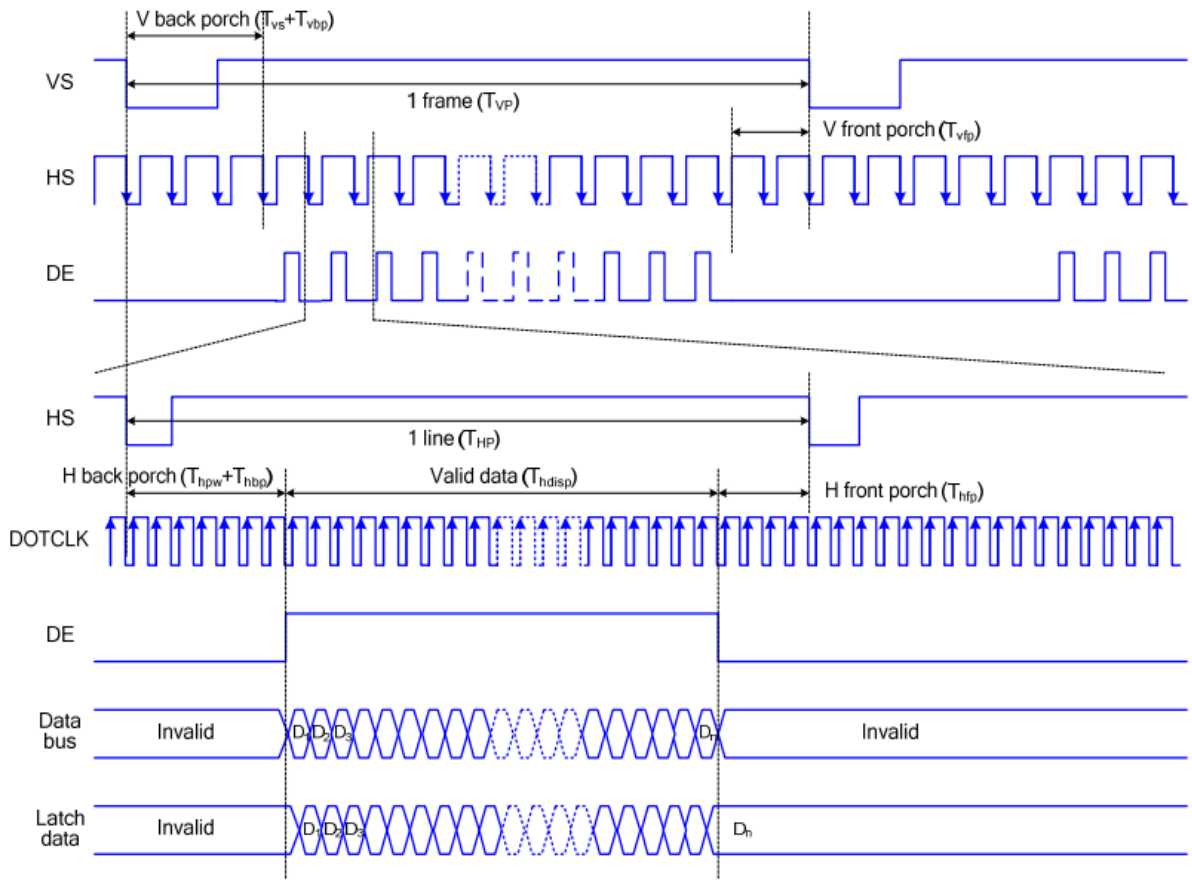
The timing chart of RGB interface DE mode is shown as follows.



Note: The setting of front porch and back porch in host must match that in IC as this mode.

Figure 23 Timing Chart of Signals in RGB Interface DE Mode

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The timing chart of RGB interface HV mode is shown as follows.

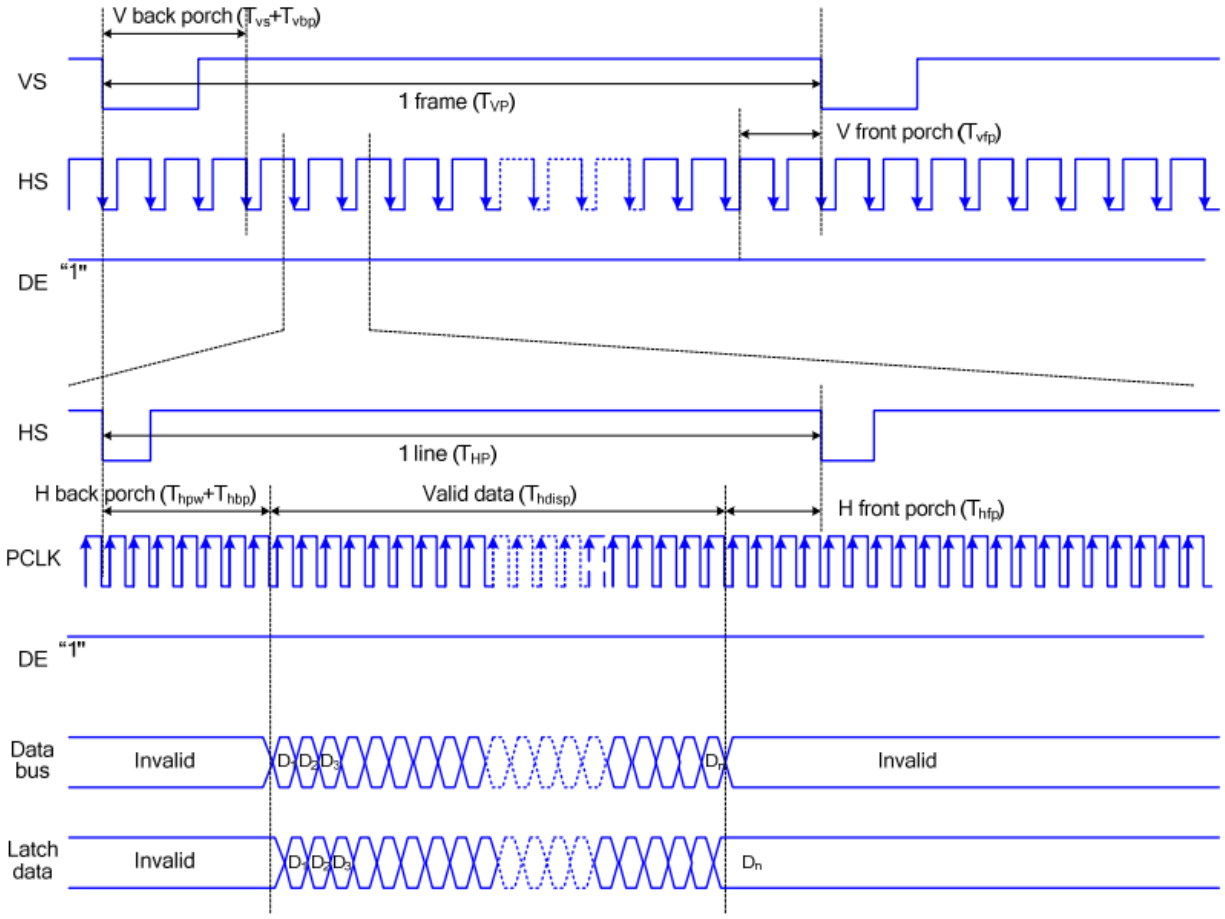

Figure 24 Timing chart of RGB interface HV mod

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6.4 Power Sequence

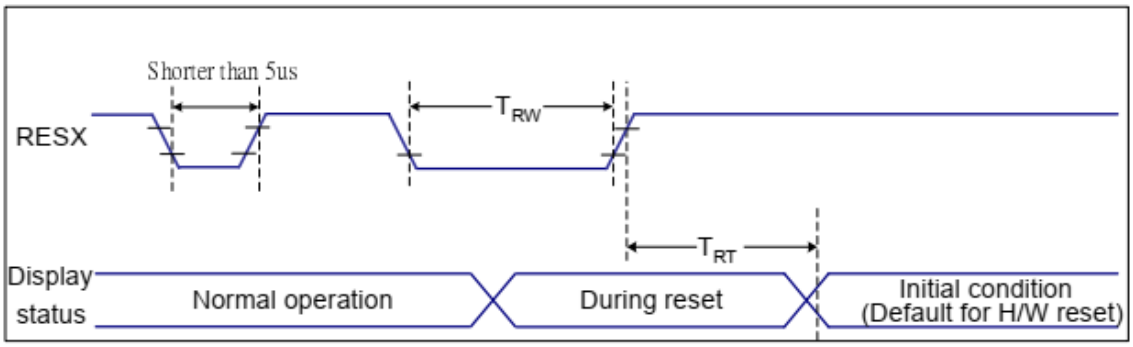

Figure 9 Reset Timing

VDDI=1.8,VDD=2.8, AGND=DGND=0V, Ta=25 ℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120(Note 1, 6, 7)	ms

Table 9 Reset Timing

Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:

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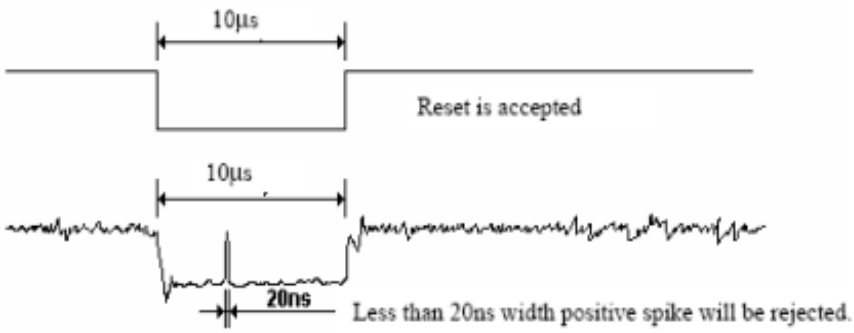

5. When Reset applied during Sleep In Mode.

6. When Reset applied during Sleep Out Mode.

7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

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7.0 RELIABILTY TEST ITEMS

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80±2℃, 48hrs	
2	Low Temperature Storage	Ta=-30±2℃, 48hrs	
3	High Temperature Operation	Ta=70±2℃, 48hrs	
4	Low Temperature Operation	Ta=-20±2℃, 48hrs	
5	High Temperature and High Humidity (non operation)	Ta=60±2℃, 90%RH, 48Hrs	
6	Thermal Cycling Test (non operation)	-20℃(30min)→+70℃(30min),10 cycles	

Note1: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

Note2: All of the function & cosmetic Judgment basis base on room temperature. (The tested module must have enough recovery time at least 2 hours at room temperature.)

Note3: The test condition definition panel's surface temperature.

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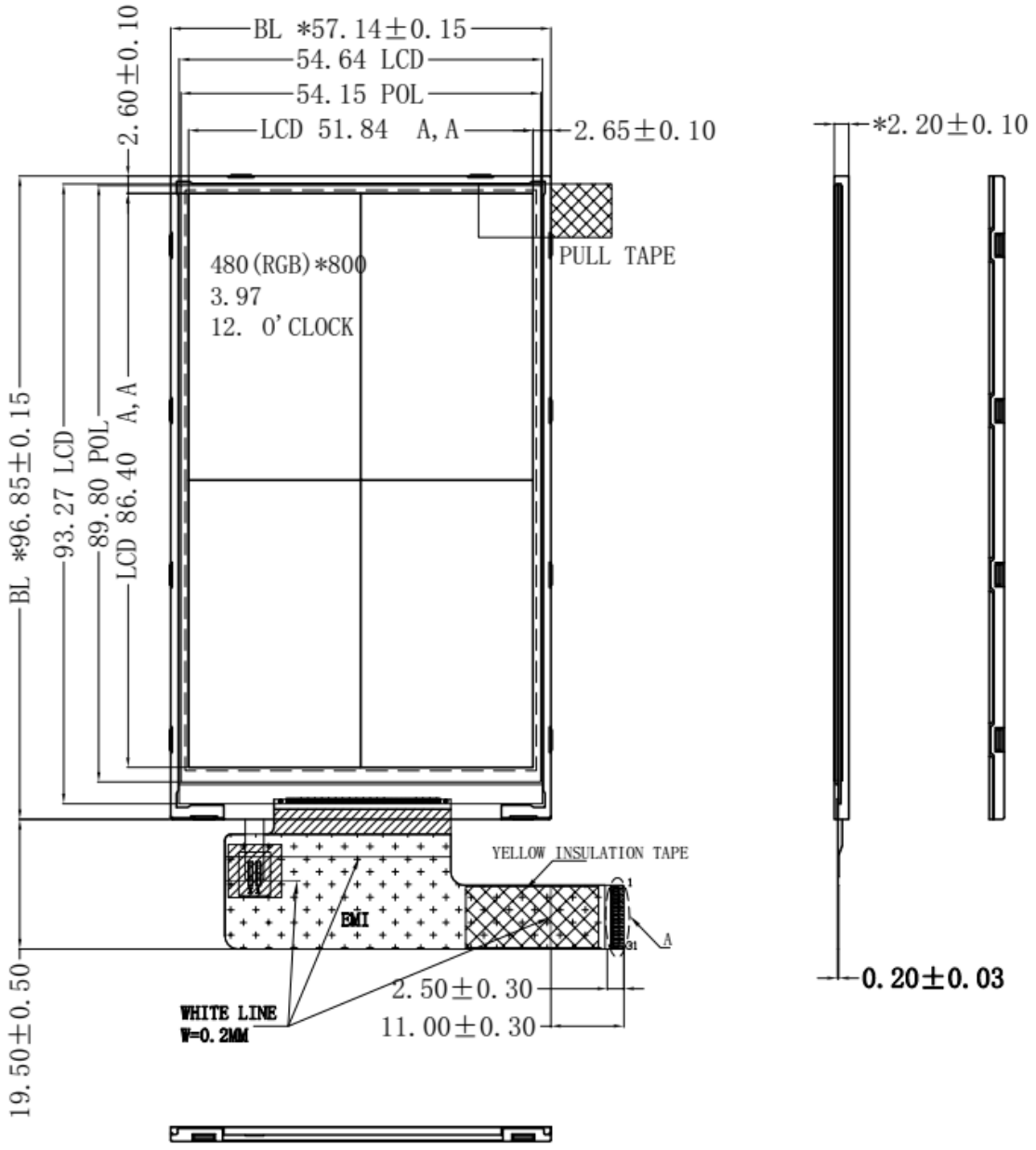
8.0 OUTLINE DIMENSION

Unit : mm



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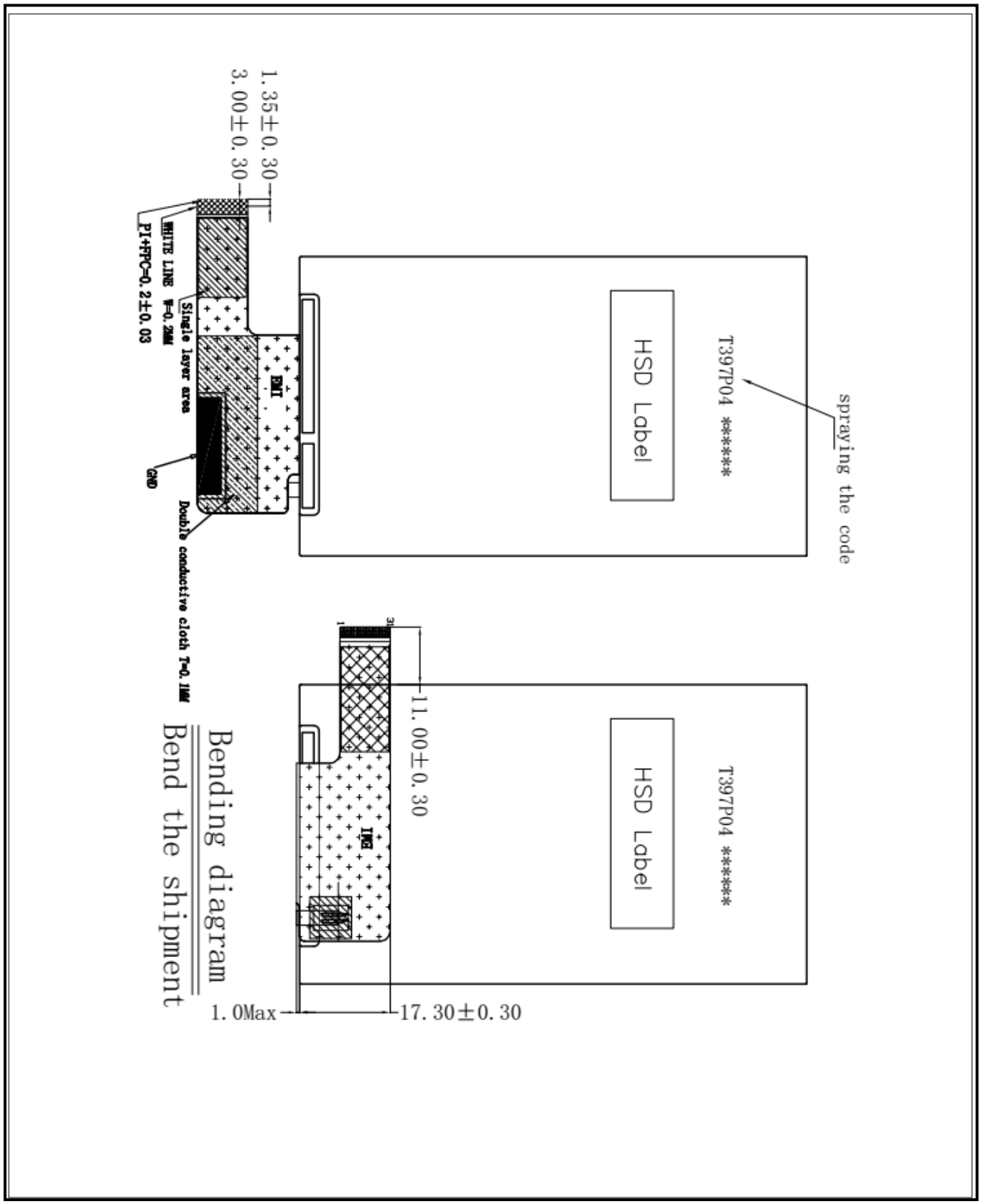

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9.0 LOT MARK

9.1 Lot Mark

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Code 1,2,3,4,5,6: HannStar internal flow control code.
Code 7: production location.
Code 8: production year.
Code 9: production month.
Code 10,11,12,13,14,15: serial number.

Note (1) Production Year: Code 8 is defined by the last number of the year, for example

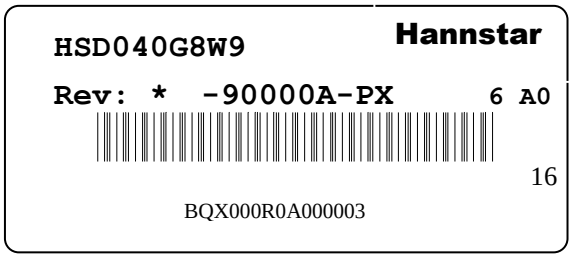
Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Mark	6	7	8	9	0	1	2	3	4	5	6

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

9.2 Detail of Lot Mark

(1) Below label is attached on the backside of the LCD module. See Section 8.0: Outline Dimension.
(2) The detail of Lot Mark is attached as below.
(3) This is subject to change without prior notice.



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10.0 PACKAGE SPECIFICATION

10.1 Packing form

TBD

10.2 Packing Drawing

TBD

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11.0 GENERAL PRECAUTION

11.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

11.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. HannStar does not warrant the module, if customers disassemble or modify the module.

11.3 Breakage of LCD Panel

11.3.2. If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

11.3.3. If liquid crystal contacts mouth or eyes, rinse out with water immediately.

11.3.4. If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

11.3.5. Handle carefully with chips of glass that may cause injury, when the glass is broken.

11.4 Electric Shock

11.4.1. Disconnect power supply before handling LCD module.

11.4.2. Do not pull or fold the LED cable.

11.4.3. Do not touch the parts inside LCD modules and the fluorescent LED's connector or cables in order to prevent electric shock.

11.5 Absolute Maximum Ratings and Power Protection Circuit

11.5.1. Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.

11.5.2. Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

11.5.3. It's recommended to employ protection circuit for power supply.

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11.6 Operation

11.6.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

11.6.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

11.6.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

11.6.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may causes deformation or color fading.

11.6.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

11.7 Mechanism

Please mount LCD module by using mounting holes arranged in four corners tightly.

11.8 Static Electricity

11.8.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

11.8.2 Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge. Persons who handle the module should be grounded through adequate methods.

11.9 Strong Light Exposure

The module shall not be exposed under strong light such as direct sunlight. Otherwise, display characteristics may be changed.

11.10 Disposal

When disposing LCD module, obey the local environmental regulations.

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