DATA MODUL

SPECIFICATION

HannStar

HSD050GHW4-A00-P

5.0” – 720 x 1280 – MIPI

Version: 2.0
Date: 16.02.2023

Note: This specification is subject to change without prior notice

TO : DATA MODUL

Date : 2023/02/16

HannStar Product Specification

4.99” Color TFT-LCD Module

Model: HSD050GHW4 -A00-P

Accepted by:	
Signature	Date
Proposed by: Technical Service Division	
Signature	Date
魁蘇 印星	2023.03.02

發行 MAR.01 2023 文件管制

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.

Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Feb., 22, 2021	A00-P	Formal Specification was first released.
2.0	Feb., 16, 2023	A00-P	Modify 10.0 PACKAGE SPECIFICATION.

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD050GHW4-A00-P 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, driving IC and a back light system. This TFT LCD has a 4.99 (9:16) inch diagonally measured active display area with HD (720 horizontal by 1280 vertical pixel) resolution.

1.2 Features

- 4.99 (9:16 diagonal) inch configuration
- 16.7M colors by 8 bit R.G.B.
- ROHS / Halogen Free Compliance

1.3 Applications

- TFT LCD Monitor
- Industrial Application
- Amusement
- Vehicle

1.4 General information

Item		Specification	Unit
Outline Dimension		64.8(H) x 118.6(V) x 1.61(D)	mm
Display area		62.1(H) x 110.4(V)	mm
Number of Pixel		720 RGB (H) x 1280 (V)	pixels
Pixel pitch		0.08625(H) x 0.08625(V)	Mm
Pixel arrangement		RGB Vertical Stripe	
Display mode		Normally Black	
Interface		MIPI	
NTSC		70 (Typ.)	%
Surface treatment		HC	
Weight		27	g
Power Consumption	Logic System	0.148 (Typ.)	W
	B/L System	0.820(Typ.)	W

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	64.65	64.8	64.95	mm
	Vertical (V)	118.45	118.6	118.75	mm
	Depth (D)	1.51	1.61	1.71	mm
Weight		--	27	--	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Supply Voltage	VCI	-0.3	6.6	V	
Digital supply voltage	VDDI	-0.3	3.6	V	
Input Voltage	Vin	-0.3	VDDI+0.3	V	

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.

(2) Ta =25±2℃

2.2 Environment Absolute Rating

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

Note 1:

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

Note 2:

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.

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 Normal viewing angle	—	800	—		(1)(2)
Response time	Rising	Tr+Tf		—	30	40	msec	(1)(3)
White luminance (Center)		Y_L		—	500	—	cd/m^2	(1)(4)
Color chromaticity (CIE1931)	White	W_x		0.28	0.31	0.34		(1)(4)
		W_y		0.30	0.33	0.36		
	Red	R_x		0.615	0.645	0.675		
		R_y		0.293	0.323	0.353		
	Green	G_x		0.295	0.325	0.355		
		G_y		0.575	0.605	0.635		
	Blue	B_x		0.113	0.143	0.173		
		B_y		0.02	0.050	0.08		
Viewing angle	Hor.	Θ_L	CR>10	—	80	—		
		Θ_R		—	80	—		
	Ver.	Θ_U		—	80	—		
		Θ_D		—	80	—		
Brightness uniformity		B_{UNI}	**Θ=0**	80	—	—	%	(5)
Optima View Direction		Free						(6)

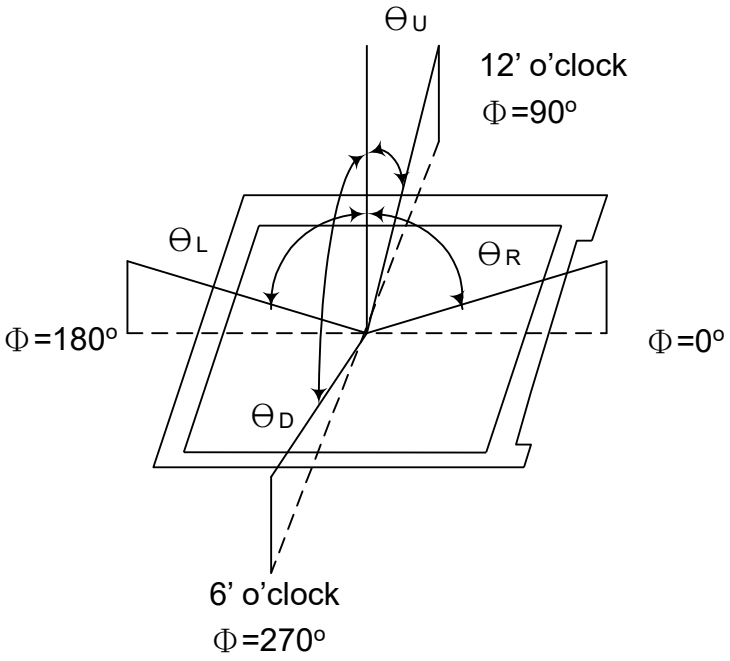
3.2 Measuring Condition

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

3.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring spot size：20 ~ 21 mm

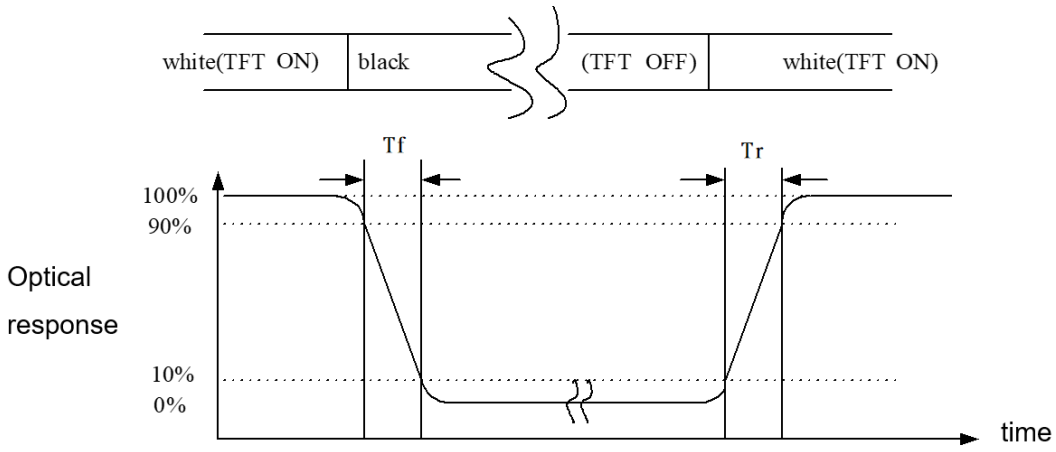
Note (1) Definition of Viewing Angle:



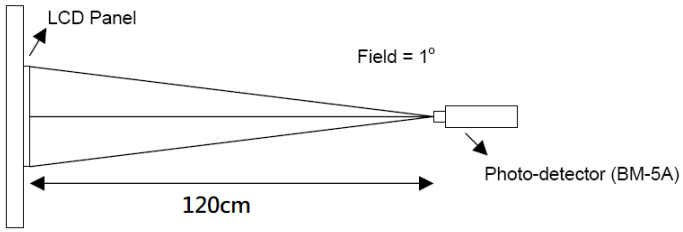
Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

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

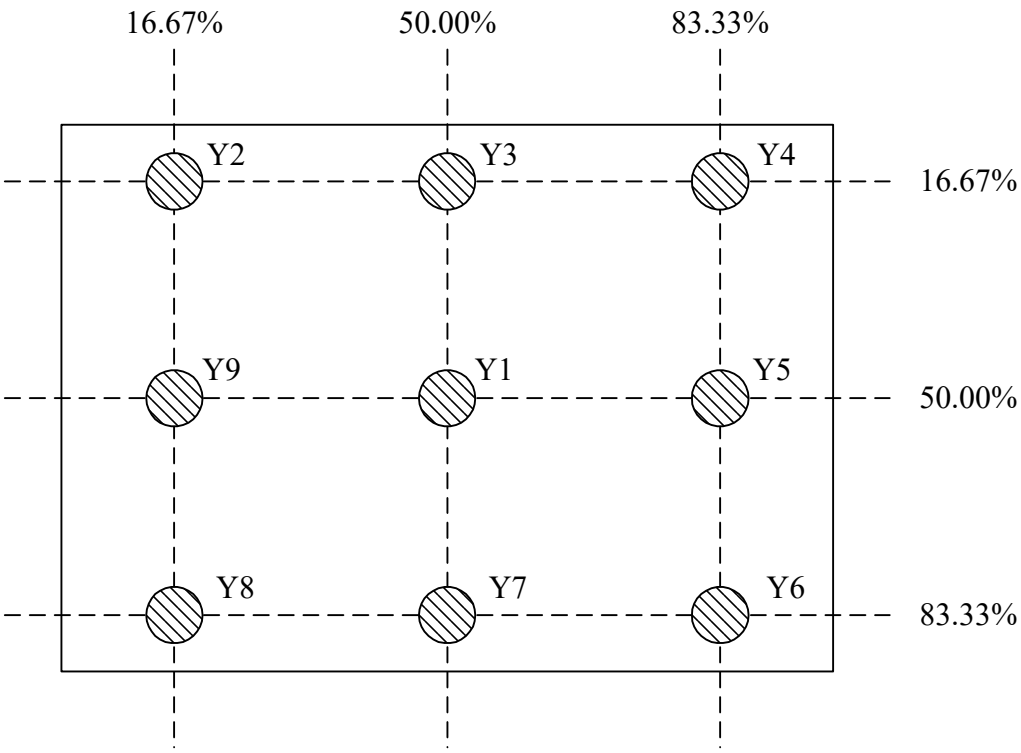
Note (3) Definition of Response Time : Sum of T_r and T_f



Note (4) Definition of optical measurement setup



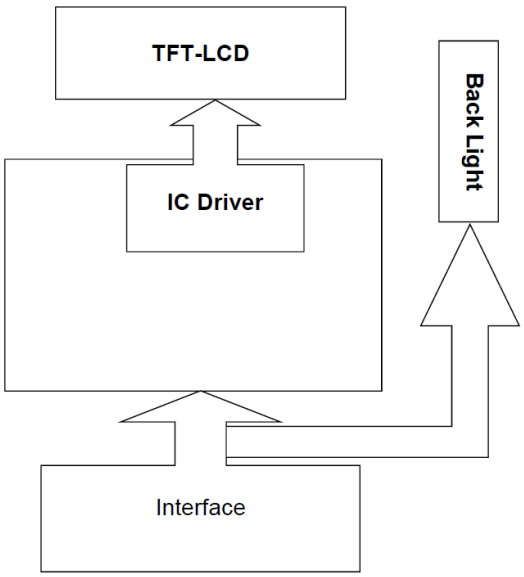
Note (5) Definition of brightness uniformity



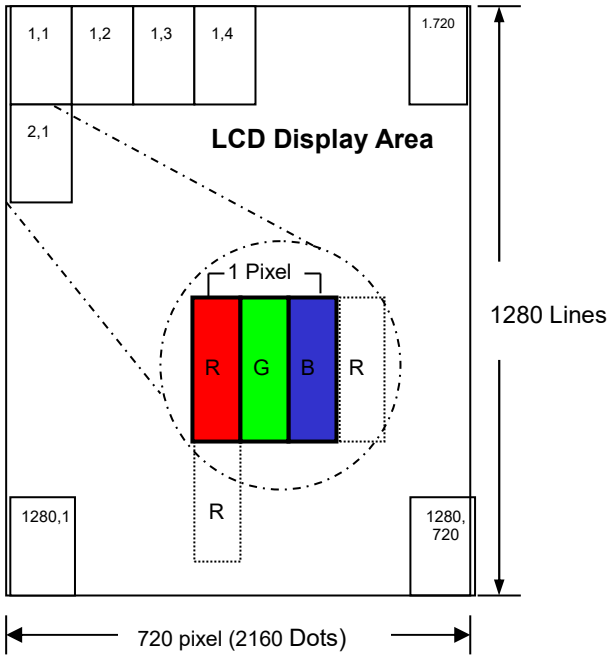
$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Pixel Format



5.0 INTERFACE PIN CONNECTION

5.1 FPC Pin Assignment:

PIN NO.	Symbol	Description
1	GND	Ground
2	D0N	Negative MIPI differential data inputs
3	D0P	Positive MIPI differential data inputs
4	GND	Ground
5	D1N	Negative MIPI differential data inputs
6	D1P	Positive MIPI differential data inputs
7	GND	Ground
8	CLKN	Negative MIPI differential clock inputs
9	CLKP	Positive MIPI differential clock inputs
10	GND	Ground
11	D3P	Positive MIPI differential data inputs
12	D3N	Negative MIPI differential data inputs
13	GND	Ground
14	D2P	Positive MIPI differential data inputs
15	D2N	Negative MIPI differential data inputs
16	GND	Ground
17	RESX	Reset pin
18	TE	Tearing effect pin
19	VDDI	Digital power supply (1.65-3.3V)
20	VCI	power supply (2.8V)
21	VCI	power supply (2.8V)
22	NC	Not connect
23	BLED-	LED Cathode
24	BLED+	LED Anode

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	VCI	2.5	2.8	6.6	V	
Supply current	I_{VCI}	-	45	56		VCI=2.8V, @white pattern and 60Hz
Digital supply voltage	VDDI	1.65	1.8	3.3	V	
Digital supply current	I_{VDDI}	-	12	15		VDDI=1.8V, @white pattern and 60Hz
Input signal voltage	ViH	0.7*VDDI	-	VDDI	V	
	ViL	0	-	0.3*VDDI	V	

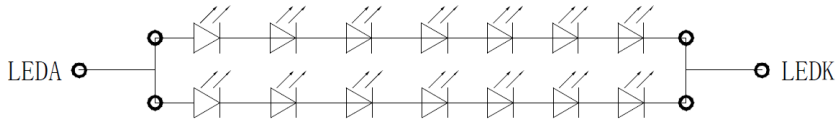
6.2 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
LED Current	I_L	--	40	--	mA	Ta=25℃
LED Voltage	V_F	19.6	20.5	22.4	Volt	Ta=25℃
LED Life-Time	N/A	30,000	--	--	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 ℃, 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 IL= 40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.

Note (3) The LED light bar circuit



6.3 DC characteristic for DSI LP mode

DC levels of the LP-00, LP-01, LP-10 and LP-11 are defined in the table below: DC Characteristics for the DSI LP mode when LP-RX, LP-CD or LP-TX is mentioned in the condition column. Other logical levels in the table are for MCU interface.

Parameter	Symbol	Condition	Specification			Unit
			Min.	Typ.	Max.	
Logic 1 input voltage	V_{IHLPCD}	LP-CD	450	-	1350	mV
Logic 0 input voltage	V_{ILLPCD}	LP-CD	0.0	-	200	mV
Logic 1 input voltage	V_{IHLPRX}	LP-RX (CLK, D0 ,D1, D2, D3)	880	-	1350	mV
Logic 0 input voltage	V_{ILLPRX}	LP-RX (CLK, D0 ,D1, D2, D3)	0.0	-	550	mV
Logic 0 input voltage	$V_{ILLPRXULP}$	LP-RX (CLK ULP mode)	0.0	-	300	mV
Logic 1 output voltage	V_{OHLPTX}	LP-TX (D0)	1.1	-	1.3	V
Logic 0 output voltage	V_{OLLPTX}	LP-TX (D0)	-50	-	50	mV
Logic 1 input current	I_{IH}	LP-CD, LP-RX	-	-	10	uA
Logic 0 input current	I_{IL}	LP-CD, LP-RX	-10	-	-	uA

6.4 DC characteristic for DSI HS mode

Parameter	Symbol	Condition	Specification			Unit
Input Common Mode Voltage for Clock	V_{CMCLK}	CLKP/N Note 2, Note 3	70	-	330	mV
Input Common Mode Voltage for Data	V_{CMDATA}	DnP/N Note 2, Note 3, Note 5	70	-	330	mV
Common Mode Ripple for Clock Equal or Less than 450MHz	$V_{CMRCLKL450}$	CLKP/N Note 4	-50	-	50	mV
Common Mode Ripple for Data Equal or Less than 450MHz	$V_{CMRDATAL450}$	DnP/N Note 4, Note 5	-50	-	50	mV
Common Mode Ripple for Clock More than 450MHz (peak sine wave)	$V_{CMRCLKM450}$	CLKP/N	-	-	100	mV
Common Mode Ripple for Data More than 450MHz (peak sine wave)	$V_{CMRDATAM450}$	DnP/N Note 5	-	-	100	mV
Differential Input Low Level Threshold Voltage for Clock	$V_{THLCLK-}$	CLKP/N	-70	-	-	mV
Differential Input Low Level Threshold Voltage for Data	$V_{THLDATA-}$	DnP/N Note 5	-70	-	-	mV
Differential Input High Level Threshold Voltage for Clock	$V_{THHCLK+}$	CLKP/N	-	-	70	mV
Differential Input High Level Threshold Voltage for Data	$V_{THHDATA+}$	DnP/N Note 5	-	-	70	mV
Single-ended Input Low Voltage	V_{ILHS}	CLKP/N, DnP/N Note 3, Note 5	-40	-	-	mV
Single-ended Input High Voltage	V_{IHHS}	CLKP/N, DnP/N Note 3, Note 5	-	-	460	mV
Differential Termination Resistor	R_{TERM}	CLKP/N, DnP/N Note 5	80	100	125	Ω
Single-ended Threshold Voltage for Termination Enable	$V_{TERM-EN}$	CLKP/N, DnP/N Note 5	-	-	450	mV
Termination Capacitor	C_{TERM}	CLKP/N, DnP/N Note 5, Note 6	-	-	60	pF

Notes:

1. Ta = -30℃ to 70℃ (to +85℃ no damage) , VCI = 2.5V to 6.6V, VDDI = 1.65V to 3.3V

2. Includes 50mV (-50mV to 50mV) ground difference

3. Without VCMRCLKM450/VCMRDATAM450

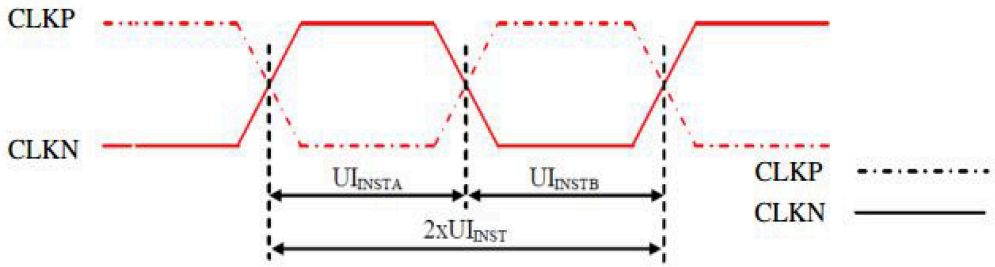
4. Without 50mV (-50mV to 50mV) ground difference

5. n = 0,1,2,3

6. For higher bit rates, a 14pF capacitor will be needed to meet the common-mode return loss specification.

6.5 Timing characteristic

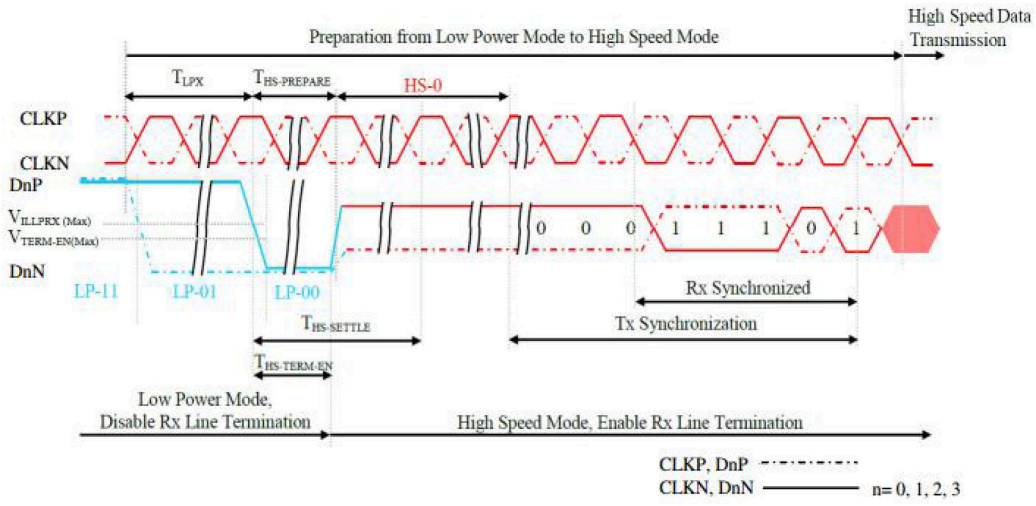
6.5.1 High Speed Mode – Clock Channel Timing



Signal	Symbol	Parameter	Min	Max	Unit
CLKP/N	$2xUI_{INST}$	Double UI instantaneous	*Note 2*	25	ns
CLKP/N	UI_{INSTA}, UI_{INSTB} (Note 1)	UI instantaneous Half	*Note 2*	12.5	ns

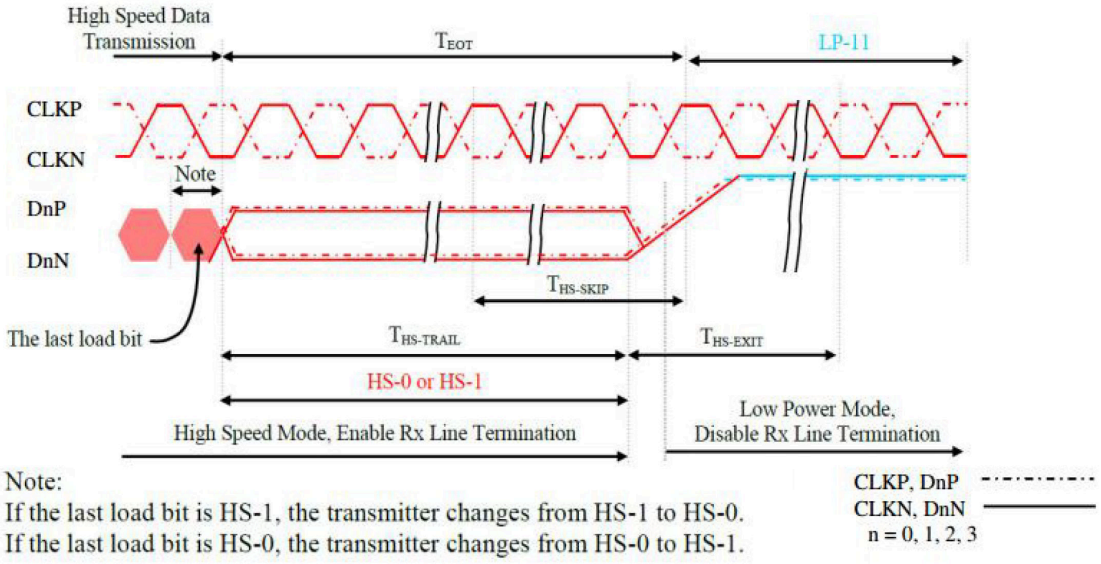
Data type	Two Lanes speed	Three Lanes speed	Four Lanes speed
Data Type = 00 1110 (0Eh), RGB 565, 16 UI per Pixel	566 Mbps	466 Mbps	366 Mbps
Data Type = 01 1110 (1Eh), RGB 666, 18 UI per Pixel	637 Mbps	525 Mbps	412 Mbps
Data Type = 10 1110 (2Eh), RGB 666 Loosely, 24 UI per Pixel	850 Mbps	700 Mbps	550 Mbps
Data Type = 11 1110 (3Eh), RGB 888, 24 UI per Pixel	850 Mbps	700 Mbps	550 Mbps

6.5.2 Data Lanes from Low Power Mode to High Speed Mode



Signal	Symbol	Description	Min	Max	Unit
DnP/N, n = 0,1,2,3	T_{LPX}	Length of any Low Power State Period	50	-	ns
DnP/N, n = 0,1,2,3	$T_{HS-PREPARE}$	Time to drive LP-00 to prepare for HS Transmission	40+4xUI	85+6xUI	ns
DnP/N, n = 0,1,2,3	$T_{HS-TERM-EN}$	Time to enable Data Lane Receiver line termination measured from when Dn crosses VILMAX	-	35+4xUI	ns

6.5.3 Data Lanes from Low Power Mode to High Speed Mode



Note:
If the last load bit is HS-1, the transmitter changes from HS-1 to HS-0.
If the last load bit is HS-0, the transmitter changes from HS-0 to HS-1.

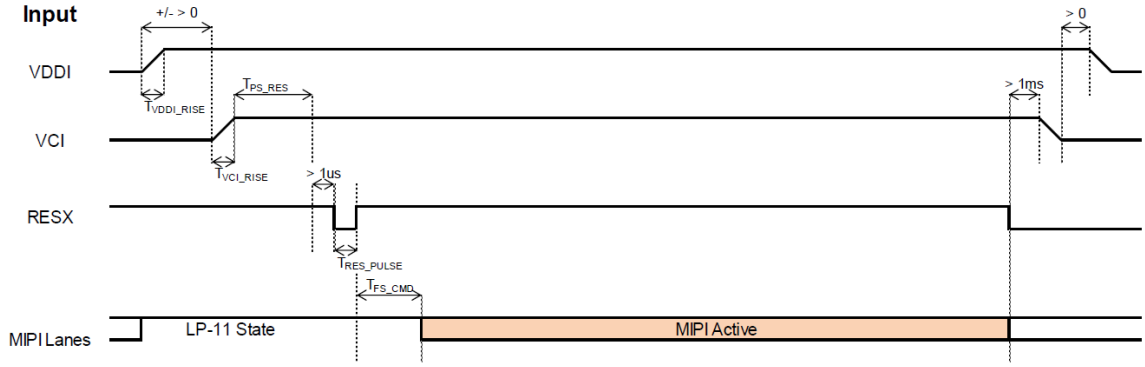
Signal	Symbol	Description	Min	Max	Unit
DnP/N, n = 0,1,2,3	$T_{HS-SKIP}$	Time-Out at Display Module (ILI9881D) to ignore transition period of EoT	40	55+4xUI	ns
DnP/N, n = 0,1,2,3	$T_{HS-EXIT}$	Time to driver LP-11 after HS burst	100	-	ns

6.6 Timing table

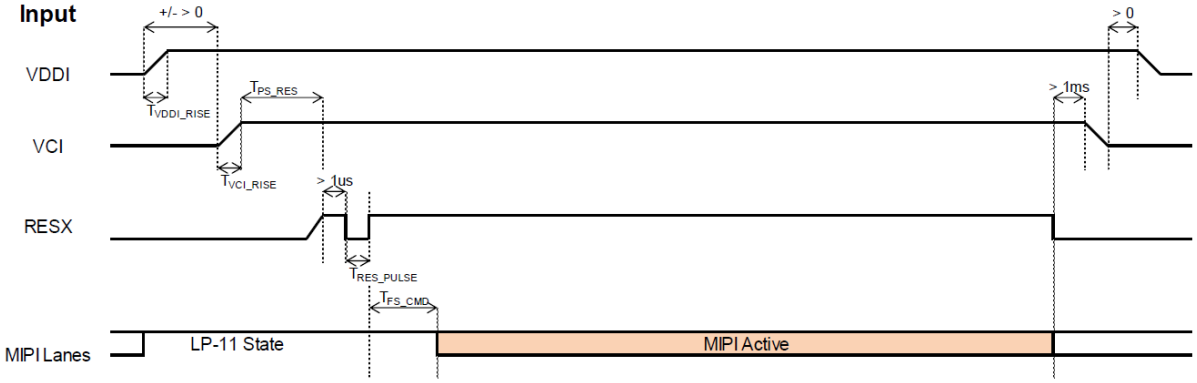
Item	Symbol	Value			Unit
		Min.	Typ.	Max.	
HS low pulse width	HS	8	20	-	DCK
Horizontal back porch	HBP	52	90	-	DCK
Horizontal front porch	HFP	52	60	-	DCK
Horizontal blanking period	HBLK		-	-	DCK
Horizontal active area	HDISP	-	720	-	DCK
Pixel Clock	PCLK	66	71	75	MHz
Vertical low pulse width	VS	2	4	-	Line
Vertical front porch	VFP	14	24	-	Line
Vertical back porch	VBP	14	24	-	Line
Vertical blanking period	VBK		-	-	Line
Vertical active area	-	-	1280	-	Line
Vertical Refresh rate	VRR	-	60	-	Hz

6.7 Power On/Off sequence

CASE A
Input



CASE B
Input



Symbol	Characteristics	Min.	Typ.	Max.	Units
T_{VDDI_RISE}	CASE A：VDDI Rise time	100	-	-	us
	CASE B：VDDI Rise time	10	-	-	us
T_{VCI_RISE}	CASE A：VCI Rise time	130	-	-	us
	CASE B：VCI Rise time	40	-	-	us
T_{PS_RES}	All Power on to Reset high	5	-	-	ms
T_{RES_PULSE}	Reset low pulse time	10	-	-	us
T_{FS_CMD}	Reset to first command	10	-	-	ms

7.0 RELIABILTY TEST ITEMS

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80℃, 240hrs	
2	Low Temperature Storage	Ta=-30℃, 240hrs	
3	High Temperature Operation	Ta=70℃, 240hrs	
4	Low Temperature Operation	Ta=-20℃, 240hrs	

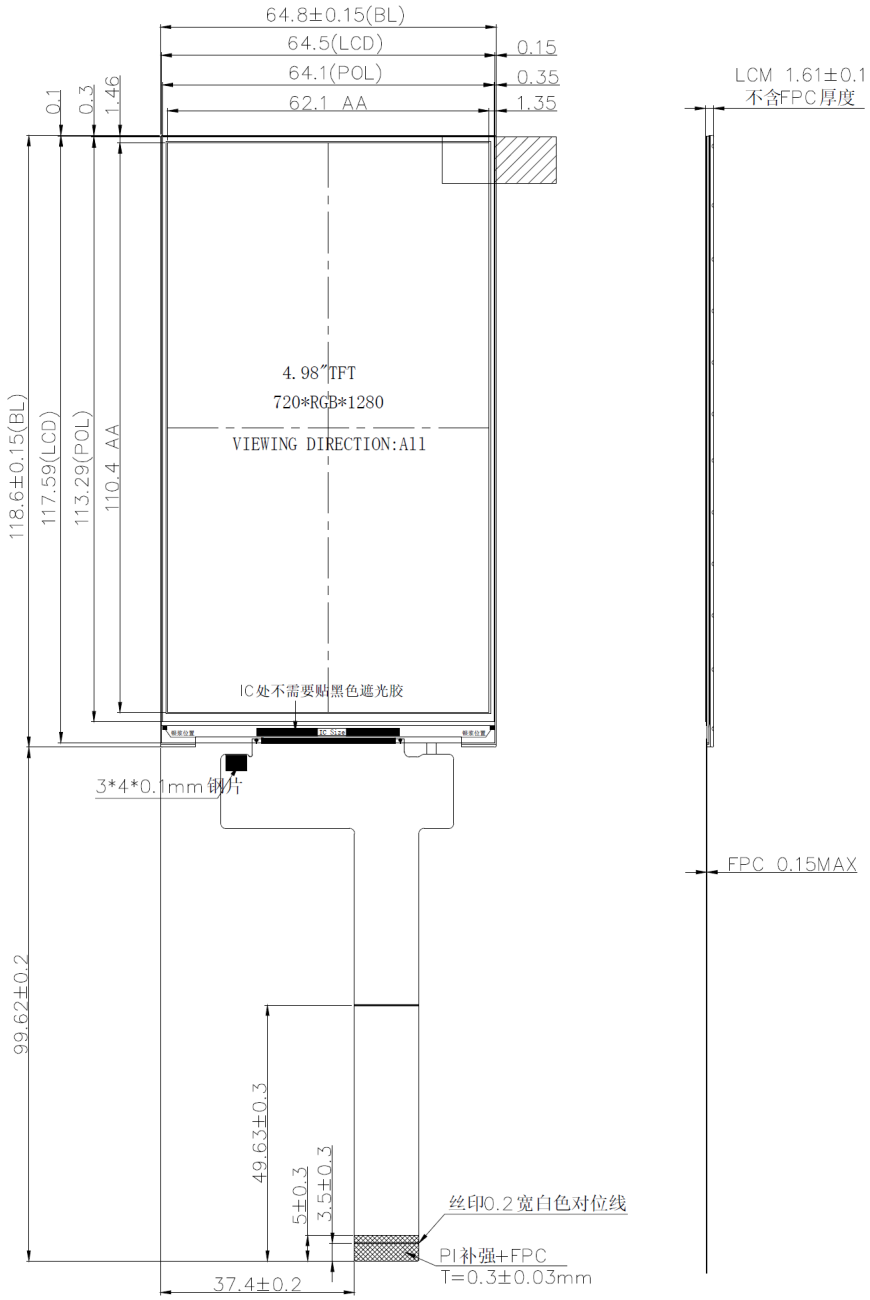
Note1: There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

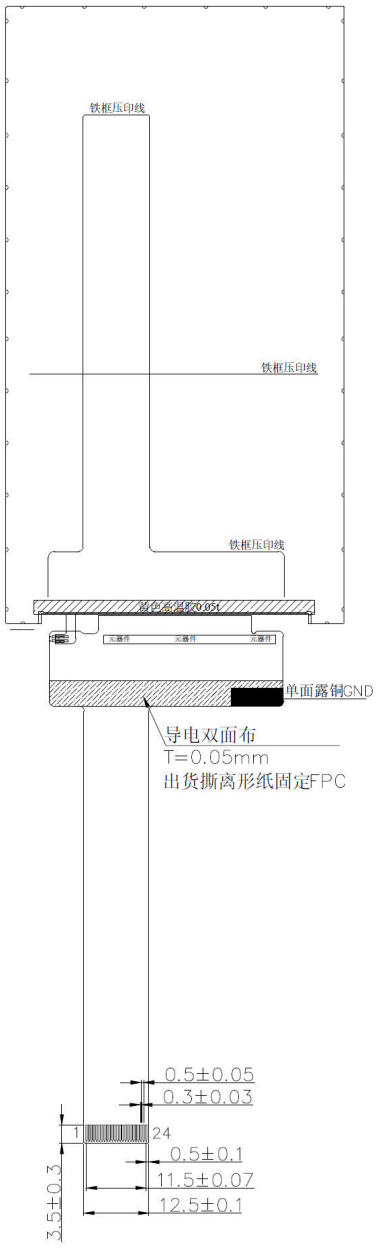
Note2: All of the function & cosmetic Judgment basis base on room temperature. (The tested module must have enough recovery time at least 2 hours at room temperature.)

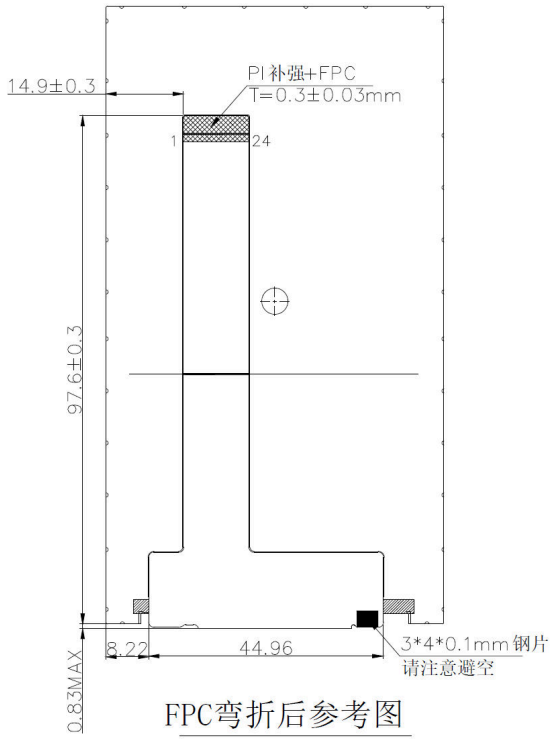
Note3: The test condition definition panel's surface temperature.

8.0 OUTLINE DIMENSION

Unit : mm







FPC弯折后参考图

FPC弯折出货

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

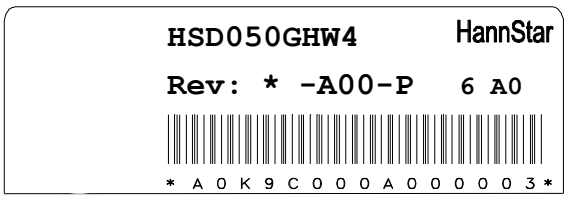
Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Mark	6	7	8	9	0	1	2	3	4	5	6

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.

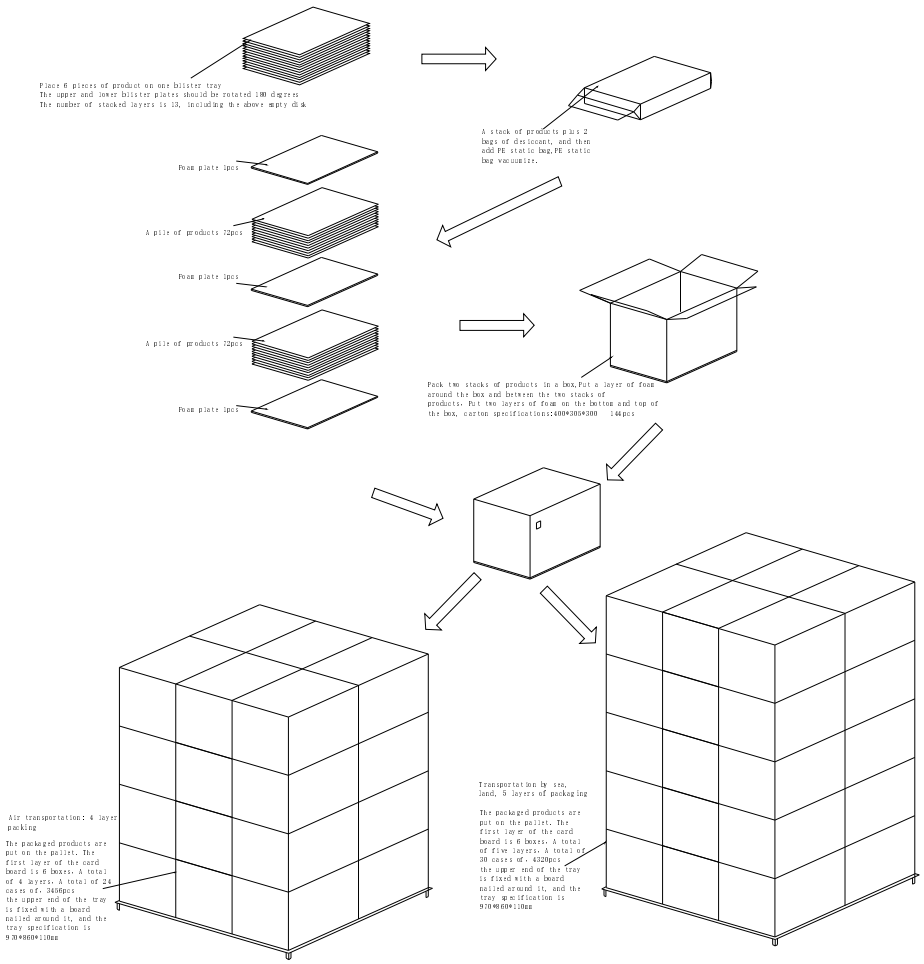


10.0 PACKAGE SPECIFICATION

10.1 Packing form

Packing name	Specification	Quantity	Notice
BOX	400*305*300mm	1	
Tray	360*265*0.8mm	26	
Foam1	360*265*10mm	3	
Foam2	285*285*10mm	2	
Foam3	360*285*10mm	2	
Vacuum bag	650*500*0.075mm	2	
Module	HSD050GHW4-A00-P	144	

10.2 Pallet Drawing



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

11.3.1 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.

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

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

11.3.4 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.

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 Static Electricity

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

11.7.2 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.

11.8 Strong Light Exposure

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

11.9 Disposal

When disposing LCD module, obey the local environmental regulations.

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