PRODUCT SPECIFICATION

MODEL: WD121SHL20JA-C3

<◇>PRELIMINARY SPECIFICATION

<◆>APPROVAL SPECIFICATION

	DESIGNED	CHECKED	APPROVED
CUSTOMER APPROVED			

	DESIGNED	CHECKED	APPROVED
SUPPLIER APPROVED	LCM RD 2018.03.31 张紫微	LCM RD 2018.03.31 朱和敏	LCM RD 2018.03.31 刘 欣

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Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Oct., 26, 2016	A**	Formal Product Specification was first issued.
1.1	Nov., 9, 2016	A**	Modify the general description P4 (Red word)

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1.0 GENERAL DESCRIPTION

XHS Display model WD121SHL20JA-C3 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 12.1 inch diagonally measured active display area with XGA (1024 horizontal by 768 vertical pixel) resolution.

1.2 Features

- 12.1 (4:3 diagonal) inch configuration
- 16.7M
- ROHS / Halogen Free Compliance

1.3 Applications

- Automobile

1.4 General information

Item		Specification	Unit
Outline Dimension		260.5 (H) x 204 (V) x 8.6 (D) (Typ)	mm
Display area		245.76(H)x184.32(V) (12.1” diagonal)	mm
Number of Pixel		1024(H) x 768(V)	pixels
Pixel pitch		0.2400(H) x 0.2400(V)	mm
Pixel arrangement		RGB Vertical Stripe	
Display mode		Normally Black	
NTSC		70(Typ.)	%
Surface treatment		Antiglare, Hard-Coating (3H)	
Weight		520(Max.)	g
Back-light		Single LED (Side-Light type)	
Power Consumption	Logic System (White Pattern)	Logic 0.8W(typ) 1.2W(max)	W
	B/L System	10.8W(max.)	W

1.5 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	260.0	260.5	261.0	mm
	Vertical (V)	203.5	204	204.5	mm
	Depth (D)	8.3	8.6	8.9	mm
Weight		–	500	520	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Logic supply voltage	V_{DD}	-0.3	5.0	V	
Back-light supply voltage	V_i	-0.3	28.0	V	

2.2 Environment Absolute Rating

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

3.0 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast		CR	Θ=0 Normal viewing angle	600	900	—		(1)(2)
Response time	Rising	TR+TF		—	30	40	msec	(1)(3)
	Falling							
White luminance (Center)		Y_L		450	600	—	cd/m^2	(1)(4) (I_L=850mA)
Color chromaticity (CIE1931)	White	W_x		0.251	0.291	0.331		(1)(4)
		W_y		0.288	0.328	0.368		
	Red	R_x		0.613	0.653	0.703		
		R_y		0.302	0.342	0.382		
	Green	G_x		0.264	0.304	0.344		
		G_y		0.581	0.621	0.661		
	Blue	B_x		0.104	0.144	0.184		
		B_y		0.054	0.094	0.134		
Viewing angle	Hor.	$Θ_L$	CR>10	80	85	—		
		$Θ_R$		80	85	—		
	Ver.	$Θ_U$		80	85	—		
		$Θ_D$		80	85	—		
Brightness uniformity		B_{UNI}	Θ=0	70	80	—	%	(5)
Optima View Direction		Free						(6)

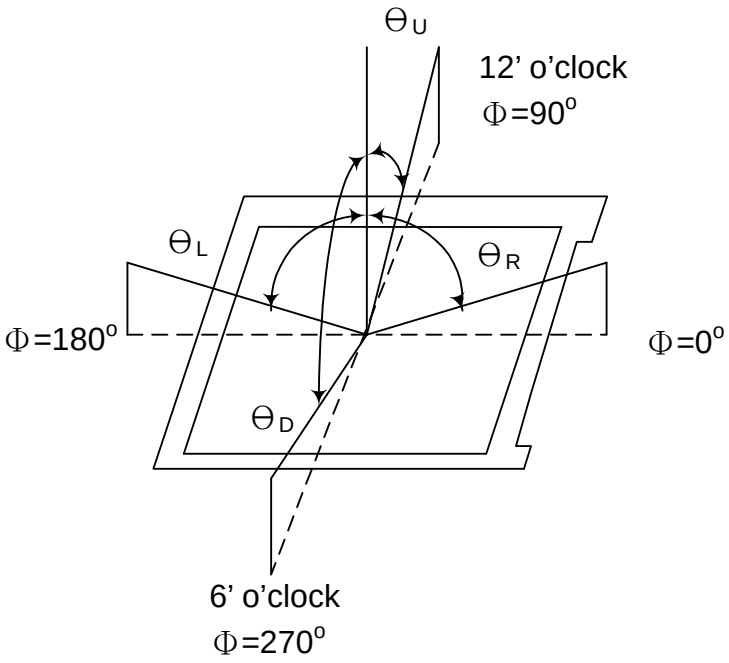
3.2 Measuring Condition

- Measuring surrounding：dark room
- LED current I_L：850mA
- 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

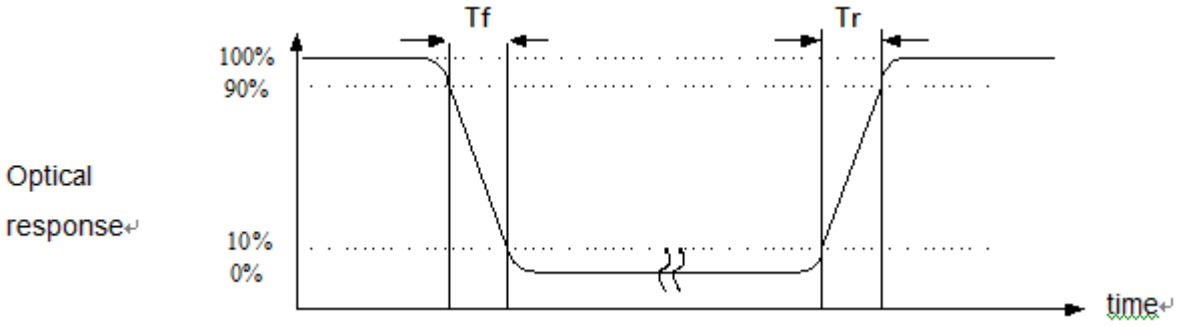
Note (1) Definition of Viewing Angle:



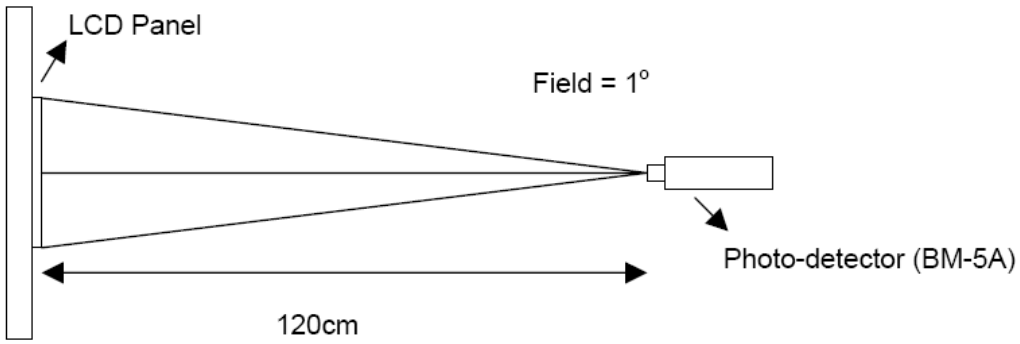
Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

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

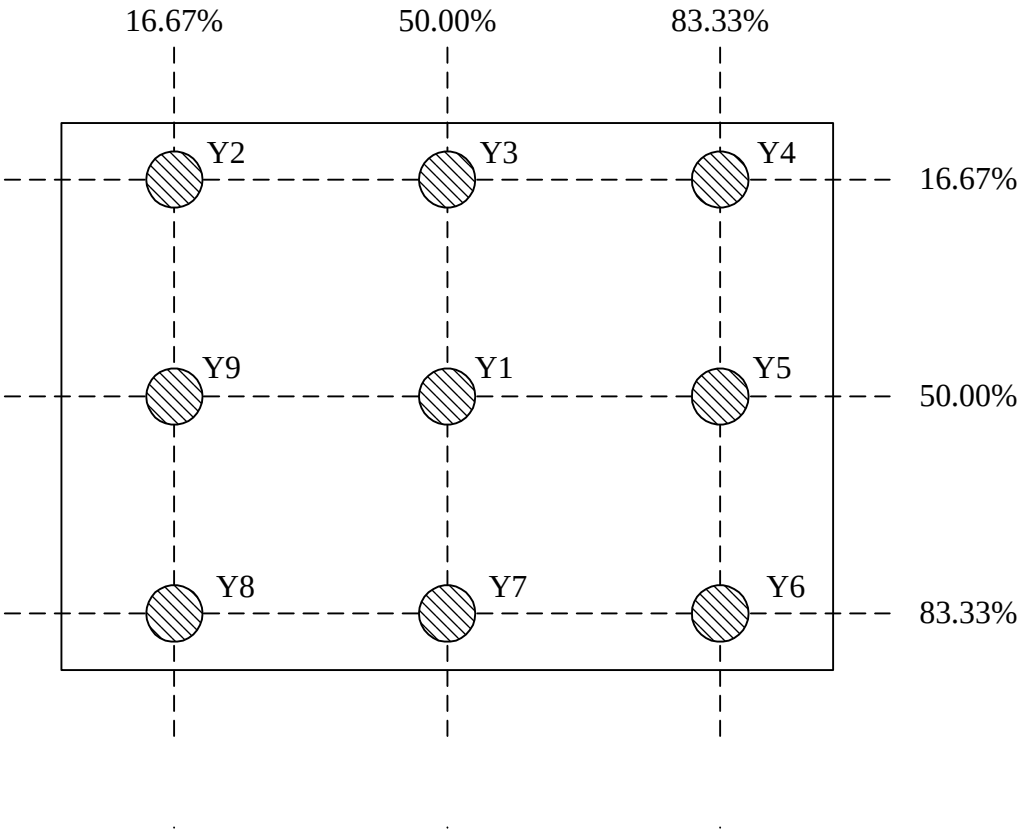
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Definition of brightness uniformity

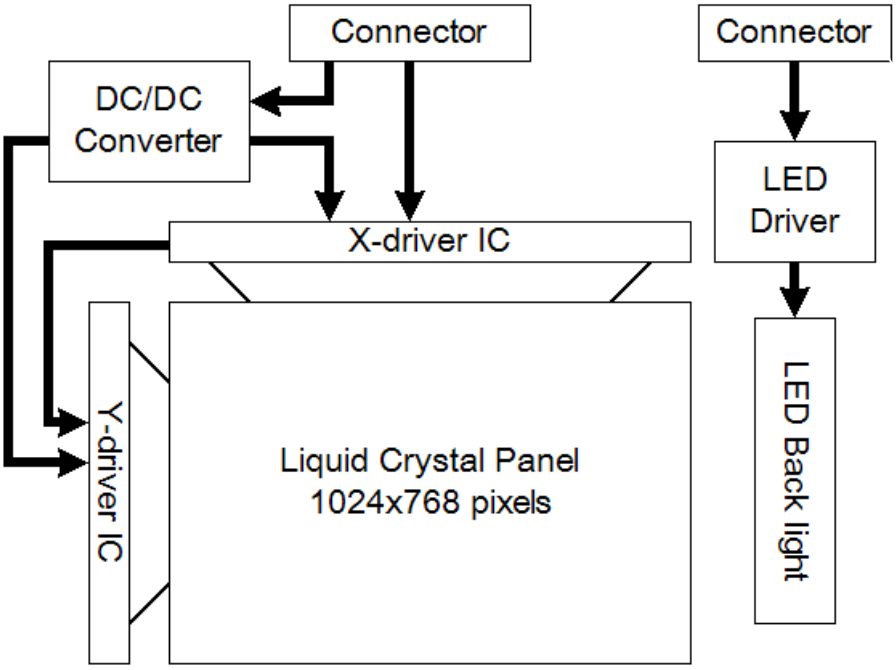


$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

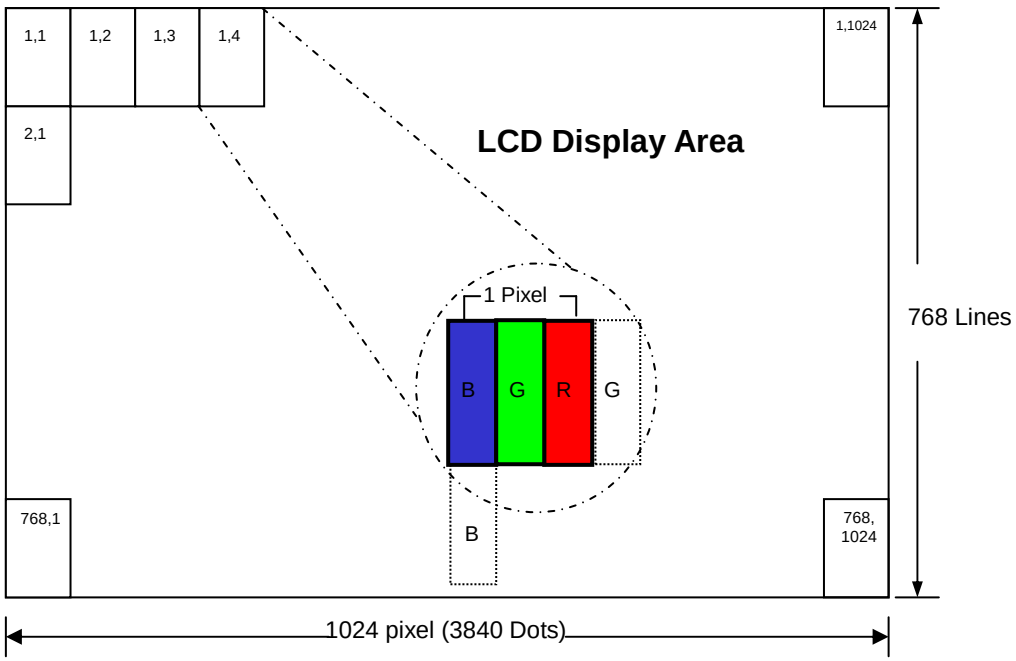
Note (6)：Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.

4.0 BLOCK DIAGRAM

4.1 TFT LCD Module:



4.2 Pixel Format



4.3 Relationship Between Displayed Color and Input

	Display	MSB R7	R6	R5	R4	R3	R2	R1	LSB R0	MSB G7	G6	G5	G4	G3	G2	G1	LSB G0	MSB B7	B6	B5	B4	B3	B2	B1	LSB B0	Gray scale Level
Basic color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
Gray scale of Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
						:								:								:				L3…L251
	↓ Light	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L252
		H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L253
		H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L254
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Red L255
Gray scale of Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L2
						:								:								:				L3…L251
	↓ Light	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L252
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L253
		L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L254
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	Green L255
Gray scale of Blue	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L2
						:								:								:				L3…L251
	↓ Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	L	L252
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	L	H	L253
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L254
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	Blue L255
Gray scale of White & Black	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark ↑	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L1
		L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L	L2
						:								:								:				L3…L251
	↓ Light	H	H	H	H	H	H	L	L	H	H	H	H	H	H	L	L	H	H	H	H	H	H	L	L	L252
		H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	L253
		H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	L	L254
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	White L255

5.0 INTERFACE PIN CONNECTION

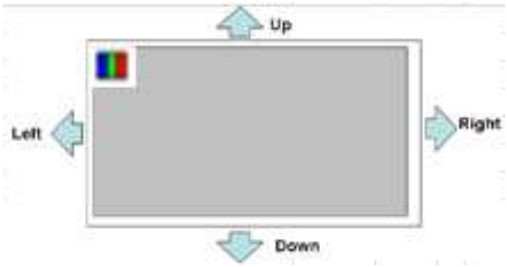
5.1 LCM connector pin assignment (CN1) : STARCONN 076B20-0048RA-G4 or JAE FI-SEB20P-HFE (or equivalent)

Pin NO.	Symbol	Description	Note
1	RX3+	Differential Data Input, CH3 (Positive)	
2	RX3-	Differential Data Input, CH3 (Negative)	
3	BIST	Normal operation/BIST pattern select. BIST="1" : BIST mode. BIST="0" : Normal operation.	Note*
4	SEL68	6bit/8bit mode select, SELB = “1” : LVDS input data is 8bits SELB = “0” : LVDS input data is 6bits	Note*
5	GND	Ground	
6	RXC+	Differential Clock Input (Positive)	
7	RXC-	Differential Clock Input (Negative)	
8	GND	Ground	
9	RX2+	Differential Data Input , CH2 (Positive)	
10	RX2-	Differential Data Input , CH2 (Negative)	
11	GND	Ground	
12	RX1+	Differential Data Input , CH1 (Positive)	
13	RX1-	Differential Data Input, CH1 (Negative)	
14	GND	Ground	
15	RX0+	Differential Data Input, CH0 (Positive)	
16	RX0-	Differential Data Input, CH0 (Negative)	
17	reLR	Left or right display control SHLR="1" : Right → Left SHLR="0" :Left → Right	Note*
18	reUD	Up / down display control UPDN="1" : Down → Up UPDN="0" : Up → Down	Note*
19	VDD	Power supply, 3.3V	
20	VDD	Power supply, 3.3V	

Note* : The high level voltage “1” is 3.3V, and the low level voltage “0” is GND.

Note 1：UPDN and SHLR control function

reLR	reUD	Data shifting
0	0	Left→Right, Up→Down
1	0	Right→Left, Up→Down
0	1	Left→Right, Down→Up
1	1	Right→Left, Down→Up



5.2 Backlight Pin Assignment (CN2) : ACES 91208-01001-H01 (or equivalent)

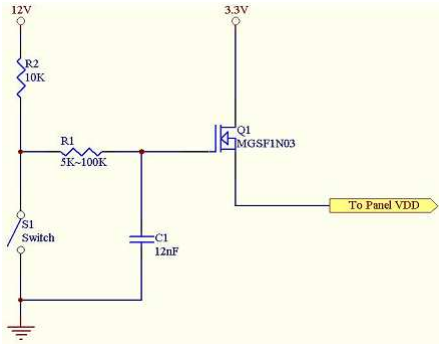
Pin NO.	Symbol	Description	Note
1	Vi	Converter input voltage	12V
2	Vi	Converter input voltage	12V
3	Vi	Converter input voltage	12V
4	Vi	Converter input voltage	12V
5	VGND	Converter ground	Ground
6	VGND	Converter ground	Ground
7	VGND	Converter ground	Ground
8	VGND	Converter ground	Ground
9	EN	Enable pin	3.3V
10	ADJ	Backlight Adjust	PWM Dimming (100Hz-30KHz, Hi: 2.0~3.3V,Lo : 0~0.8V)

6.0 ELECTRICAL CHARACTERISTICS

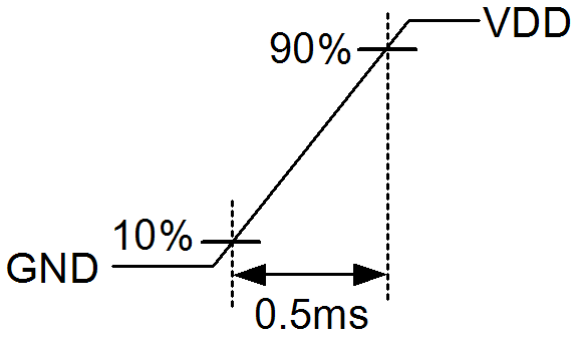
6.1 TFT LCD Module

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{DD}	3.0	3.3	3.6	V	
Current of power supply	I_{DD}	—	0.25	—	A	V_{DD} =3.3V、white pattern (L255)
VDD Power	P_{DD}	—	0.8	1.2	W	V_{DD} =3.3V、white pattern (L255)
Inrush current	I_{RUSH}	—	—	2.0	A	Note*

Note* : Inrush current test circuit and rising time setting (power on)



Test circuit



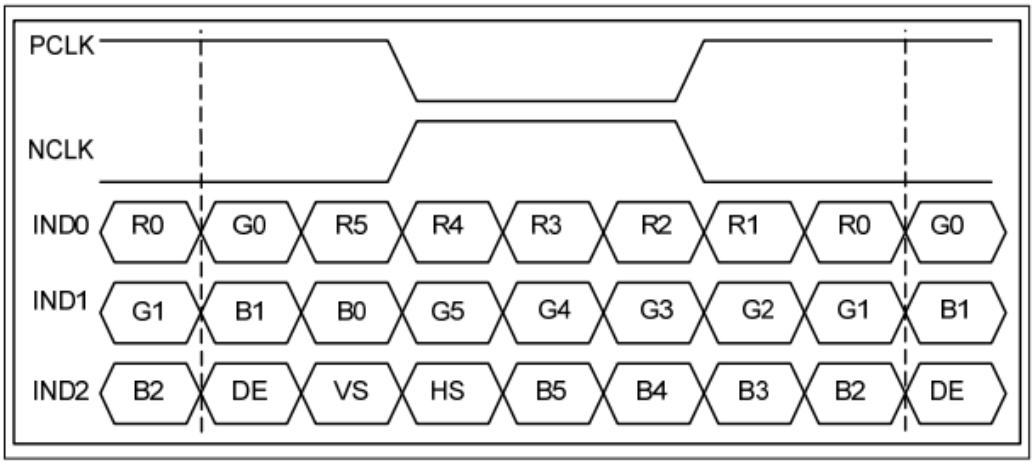
Rising time

6.2 Switching Characteristics for LVDS Receiver

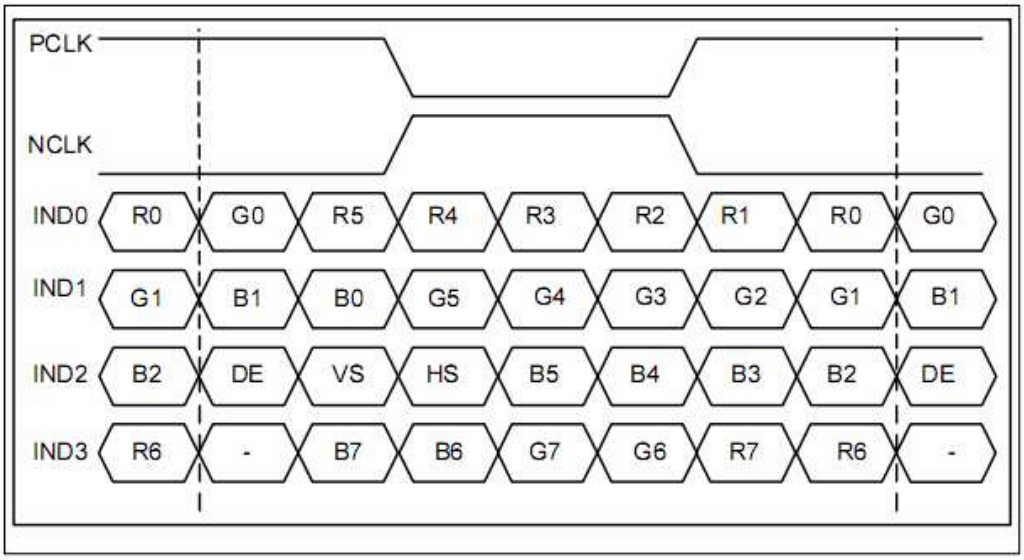
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
Differential Input High Threshold	V_{TH}	100	-	300	mV	
Differential Input Low Threshold	V_{TL}	-300	-	100	mV	
Differential input common mode voltage	V_{CM}	1.0	1.2	1.7-$\|V_{ID}\|$/2	V	
Input Current	I_{IN}	-10	-	10	uA	RX+/-, RXC+/-
Differential input Voltage	$\|V_{ID}\|$	200	-	600	mV	

6.3 Bit LVDS input

6.3.1 6bit LVDS input



6.3.2 8Bit LVDS input

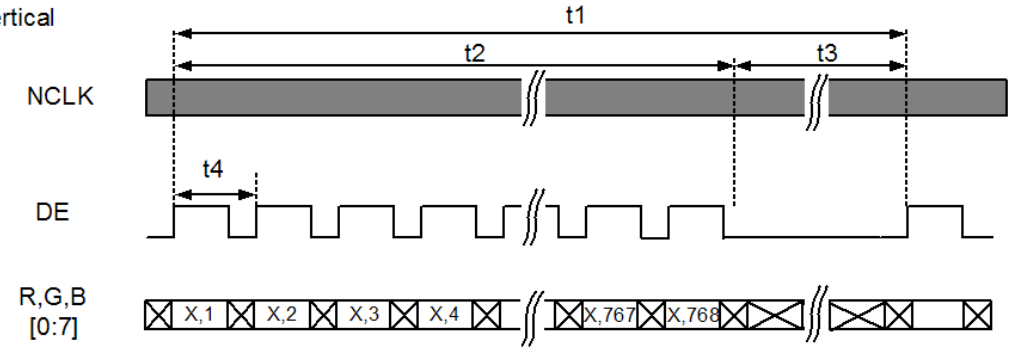


6.4 Interface Timing (DE mode)

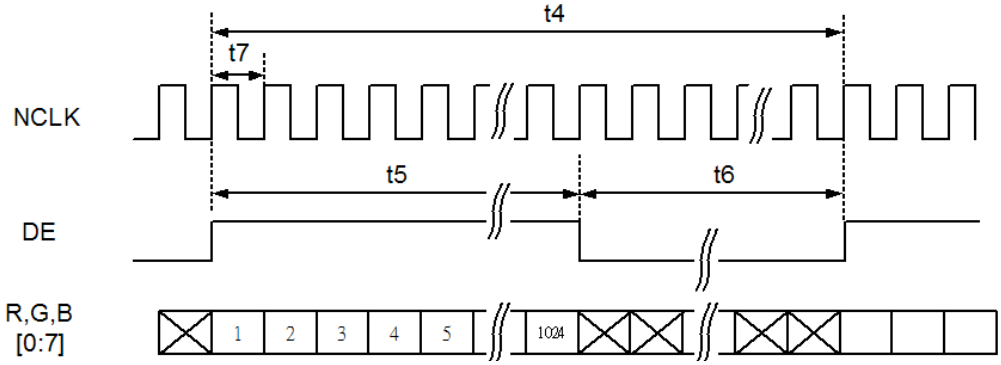
Item	Symbol	Min.	Typ.	Max.	Unit
Frame Rate	--	59.95	60.05	60.15	Hz
Vertical Total Time	T_V	774	776	778	line
Vertical Display Time	T_{VD}		768		line
Vertical Blanking Time	T_{VB}	6	8	10	line
Horizontal Total Time	T_H	1084	1088	1092	clock
Horizontal Display Time	T_{HD}		1024		clock
Horizontal Blanking Time	T_{HB}	60	64	68	clock
Clock Rate	$1/T_{Clock}$	50.3	50.7	51.1	MHz

Timing Diagram of Interface Signal (DE mode)

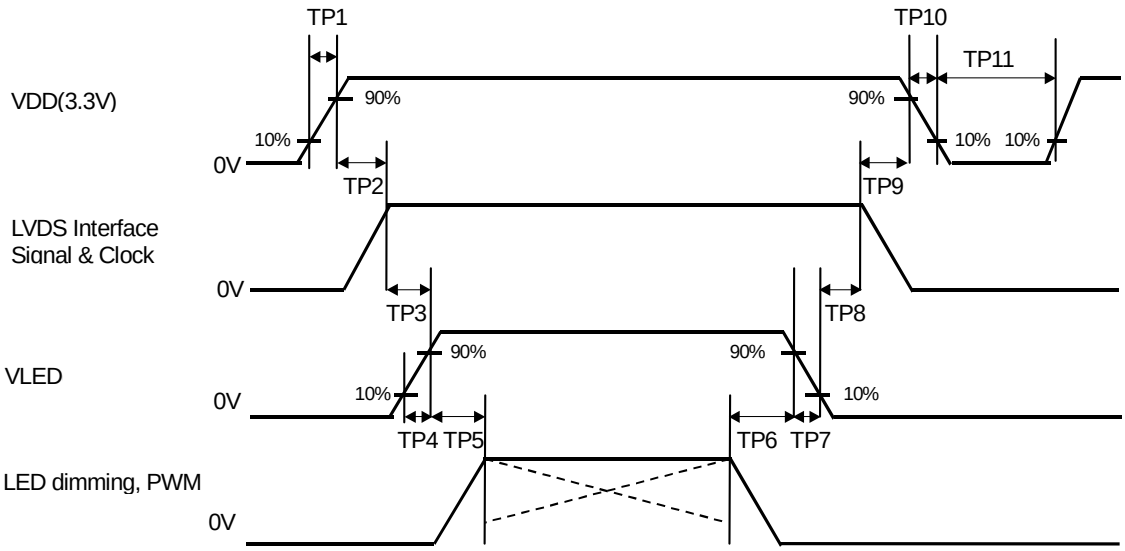
1. Vertical



2. Horizontal



6.5 Power On / Off Sequence



Item	Min.	Typ.	Max.	Unit
TP1	0.5	--	10	msec
TP2	0	--	50	msec
TP3	200	--	--	msec
TP4	0.5	--	10	msec
TP5	10	--	--	msec
TP6	10	--	--	msec
TP7	0	--	10	msec
TP8	200	--	--	msec
TP9	0	--	50	msec
TP10	1	--	10	msec
TP11	1000	--	--	msec

6.6 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Condition
Input Current	I_i	--	850	1200	mA	Ta=25℃
Input Voltage	V_i	10	12	16	Volt	Ta=25℃
LED Life-Time	N/A	30,000	--	--	Hour	Ta=25℃ I_F=52.5mA Note (2)

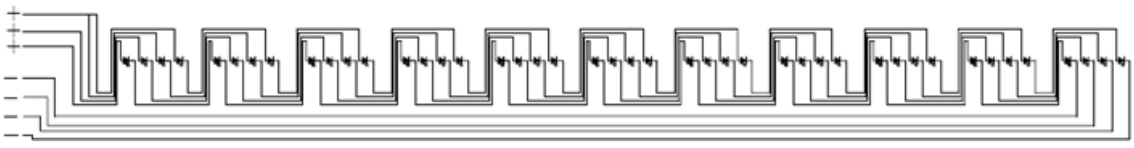
6.7 Backlight DC Electrical Characteristics

Parameter	Symbol	Min	Typ	Max	Units	Note
Backlight Power Supply	Vi	10	12	16	Volt.	
LED_EN High Threshold	V_{ENH}	1.4	3.3	5.0	Volt.	
LED_EN Low Threshold	V_{ENL}	0	--	0.8	Volt.	
PWM High Threshold	V_{PWMH}	2.0	3.3	6.0	Volt.	
PWM Low Threshold	V_{PWML}	0	--	0.8	Volt.	
PWM Frequency	F_{PWM}	100	--	30K	Hz	Note (4)
PWM Duty Cycle	T_D	10	--	100	%	

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

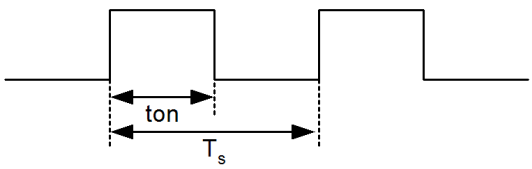
Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and I_i=850mA, the LED lifetime could be decreased if operating IL is larger than 850mA. The constant current driving method is suggested.

Note (3) LED Light Bar Circuit



BLU circuit：11S-4P

Note (4) Dimming controller waveform



T_D= ton ÷ T_s × 100%

F_{PWM}= 1 ÷ T_s

7.0 Reliability test items

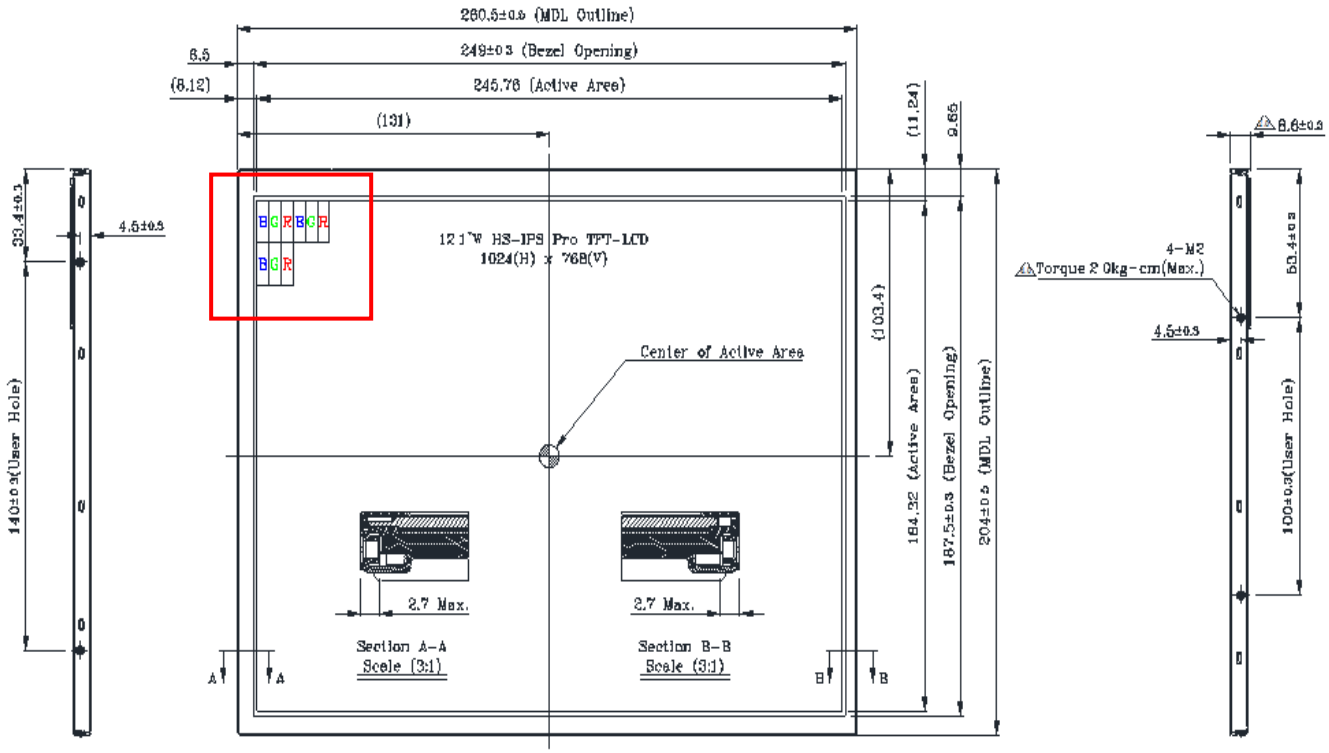
No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80°C, 1000hrs	
2	Low Temperature Storage	Ta=--30°C, 1000hrs	
3	High Temperature Operation	Ta=+70°C, 500 hrs	
4	Low Temperature Operation	Ta=-30°C, 500hrs	
5	High Temperature and High Humidity (operation)	Ta=+60°C, 90%RH, 500hrs	
6	Thermal Cycling Test (non operation)	-30°C(30min) → +80°C(30min), 500 cycles	
7	Electrostatic Discharge	±200V,200pF(0Ω) 1 time/connector	
8	Vibration	1.Random: 1.04G, 5~500Hz, XYZ, 30min/each direction 2.Sine: Freq.1.5G, 8~33.3Hz, Stoke: 1.3mm Sweep: 2.9G, 33.3~400Hz X/Z: 2hrs, Y: 4hrs	
9	Shock	Half-Sine, 100G, 6ms, ±XYZ, 3time	
10	Vibration (with carton)	Random: 0.015G^2/Hz, 5~200Hz -6dB/Octave, 200~400Hz XYZ 各方向 2hrs	
11	Drop (with carton)	Drop height condition, basis on the product weight and follow QB100-0027 1 corner, 3 edges, 6 surfaces	

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

8.0 OUTLINE DIMENSION

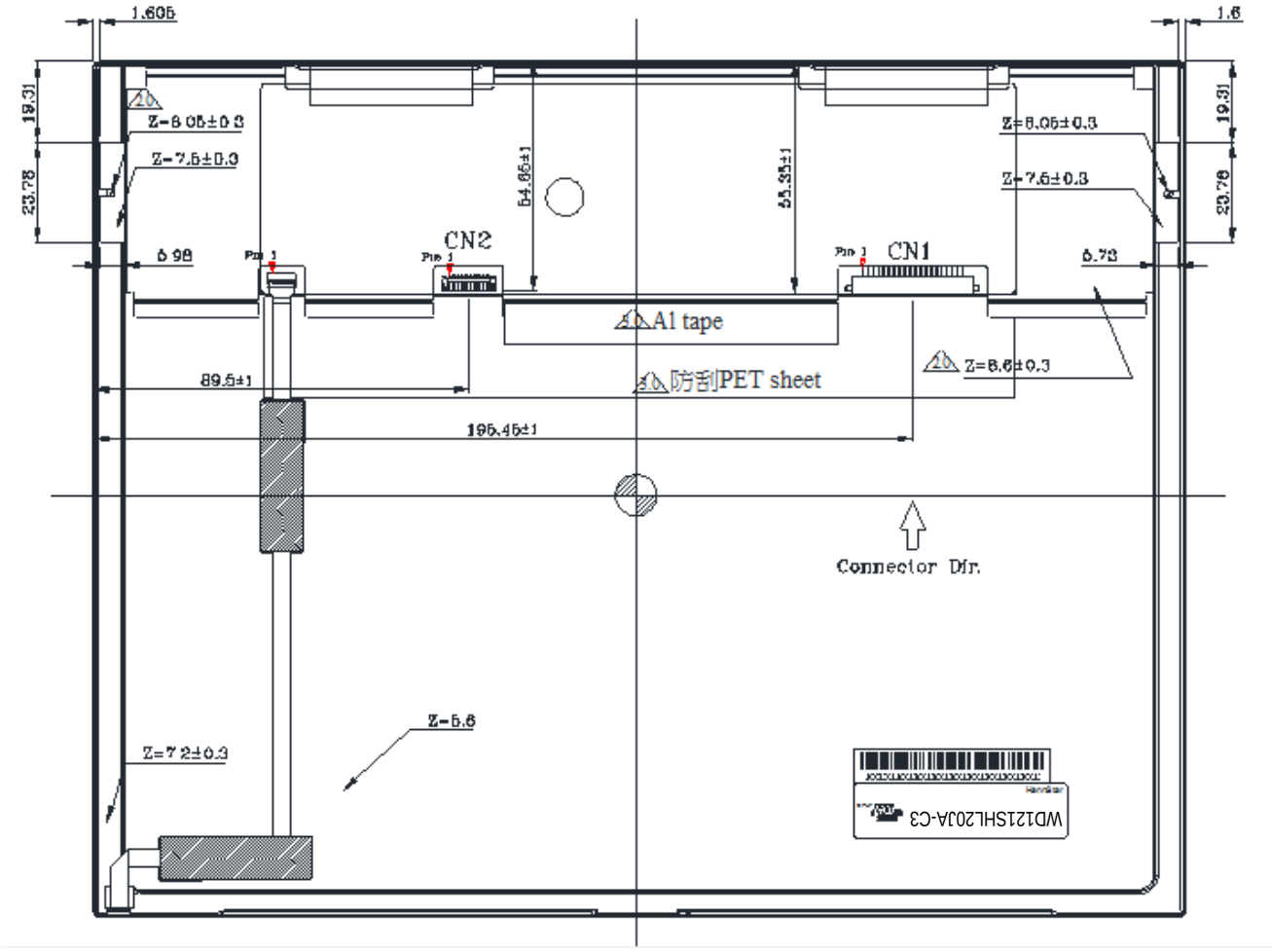
Unit : mm

8.1 Front View:



General tolerance: ±0.5mm

8.2 Rear View:



General tolerance: ±0.5mm

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

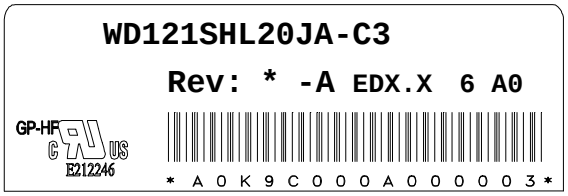
Year	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Mark	6	7	8	9	0	1	2	3	4	5

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.

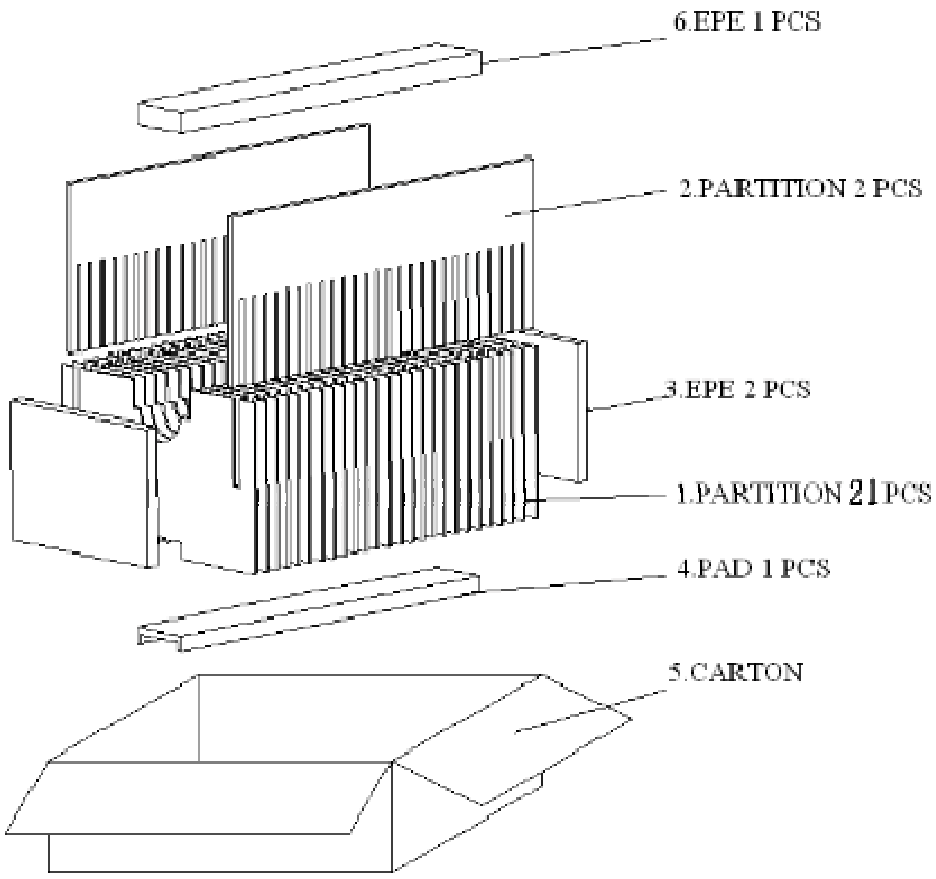


10.0 PACKAGE SPECIFICATION

10.1 Packing form

LCM Model	Qty. in the Box	Inner Box Size(mm)	Notice
WD121SHL20JA-C30	20 pcs/Box	R360 x 345 x 285H	--

10.2 Packing assembly drawings



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 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.