HannStar

Document Title	HSD024B3N5-D** Formal Specification	Page No.	1 / 26
Document No.	DC140-002202	Revision	1.7

To :

Date : May, 16, 2016

HannStar Product Specification

(Formal)

Model : HSD024B3N5-D**

(1/4 Cut)

Note:

1. Please contact HannStar Display Corp. before designing your product based on this module specification.
2. 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.
3. The mark "**" of Model means sub-model code.

Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Aug. 01, 2012	-	Formal specification was first issued.
1.1	Nov. 06, 2012	-	Modify 3.2 TFT Design Rules (P8)
			Modify 6.4 Driver IC Block Position (P18)
1.2	Nov. 20, 2012	-	Add 3.0 Electrical Specifications (For special customer) (P28)
1.3	Jul.11, 2014	-	Add 4.1 Optical specification_Tr with POL Spec (P27)
1.4	Feb.12, 2015	-	Add 4.1 Optical Specification (P29)
1.5	Apr. 07, 2015	-	Add 4.1 Optical Specification- color gamut (P29)
1.6	Nov. 06, 2015	D20	Add 4.1 Optical Specification (P30, P31)
1.7	May, 16, 2016	-	Modify the Package Specification. (P23~P28)

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD024B3N5-D is a color active matrix thin film transistor (TFT) liquid crystal display without polarizer. This model is composed of amorphous silicon TFT as a switching device. It is a transmissive type display operating in the normally white mode.

This TFT LCD has a 2.4-inch diagonally measured active display area with 720 x 320 dot (240 horizontal by 320 vertical pixel) resolution. Each pixel is divided into Red, Green, Blue dots which are arranged in vertical stripes.

1.2 Applications

■ Mobile device applications

1.3 General Information

Item	Specification	Unit
Glass Dimension	40.58(H) x 56.96(V) x 0.8(T) (Typ.)	mm
Display Area	36.72(H) x 48.96(V)	mm
Number of Pixel	240 RGB(H) x 320(V)	pixels
Pixel Pitch	0.153(H) x 0.153(V)	mm
Pixel Arrangement	RGB Vertical stripe	
Display Mode	Normally white	
Display Color	262K(6bit)	

2.0 ABSOLUTE MAXIMUM RATINGS

(The following are maximum values which, if exceeded, may cause operation or damage to the unit.)

Item	Symbol	Min.	Max.	Unit	Note
LC Operating Voltage	VOP	--	4.5	V	*1,*2
Operating Temperature	T_{OP}	-20	70	℃	
Storage Temperature	T_{ST}	-30	80	℃	
Operating Ambient Humidity	H_{OP}	10	*4	RH	*3
Storage Humidity	H_{ST}	10	*4	RH	*3

Note:

*1. At 25±5℃

*2. Due to the characteristics of LC Material, the Liquid Crystal driving voltage varies with environmental temperature.

*3. Non-condensation.

*4. Temp.≤ 60℃,90%RH Max.

Temp. > 60℃,Absolute humidity shall be less than 90%RH.

3.0 ELECTRICAL SPECIFICATIONS

Item	Symbol	Min.	Typ.	Max.	Unit	Note
TFT Gate ON Voltage	VGH		15		V	*1,*2
TFT Gate OFF Voltage	VGL	--	-7.5		V	
TFT Common Voltage	Vcom	-1.5	--	3.5	V	
Data (RGB signal) Voltage	Vsig	0.2	--	5.2	V	

Note:

*1. VGH is TFT Gate operating Voltage.

*2. VGL is TFT Gate operating Voltage.

The storage structure of this model is C_{ST}(Storage on Common)

*3. Vcom must be adjusted to optimize display quality _Cross talk, Contrast Ratio and etc.

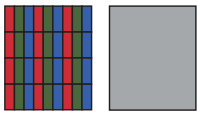
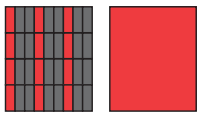
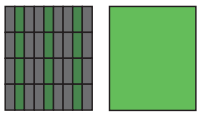
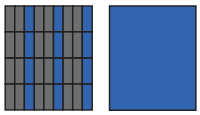
3.1 FPC Pin Assignment

1	DUMMY	36	VDDI	71	RDX	106	C11P
2	NULL	37	DB<23>	72	WRX	107	C12M
3	VCOM	38	DB<22>	73	DCX	108	C12M
4	VCOM	39	DB<21>	74	CSX	109	C12M
5	VCOM	40	DB<20>	75	RESX	110	C12P
6	FPC R_OUT	41	DB<19>	76	IM<0>	111	C12P
7	FPC R_IN	42	DB<18>	77	IM<1>	112	C12P
8	NC	43	VDDI_LED	78	IM<2>	113	AVDD
9	VCOM	44	LEDON	79	IM<3>	114	AVDD
10	VCOM	45	LEDPWM	80	EXTC	115	AVDD
11	VCOM	46	SDO	81	VGS	116	VGL
12	DUMMYR2	47	TE	82	VSSA	117	VGL
13	DUMMYR1	48	DB<17>	83	VSSA	118	VGH
14	C31M	49	DB<16>	84	VSSA	119	VGH
15	C31M	50	DB<15>	85	VSSA	120	C21M
16	C31M	51	DB<14>	86	VSSC	121	C21P
17	C31P	52	DB<13>	87	VSSC	122	C22M
18	C31P	53	DB<12>	88	VSSC	123	C22P
19	C31P	54	DB<11>	89	VSS	124	VCOM
20	VCL	55	DB<10>	90	VSS	125	VCOM
21	VCL	56	DB<9>	91	VSS	126	VCOM
22	VCL	57	DB<8>	92	VSS3	127	NC
23	VCL	58	DB<7>	93	VSS3	128	FPC R_OUT
24	GVDD	59	DB<6>	94	VCI	129	FPC R_IN
25	GVDD	60	DB<5>	95	VCI	130	VCOM
26	GVDD	61	DB<4>	96	VCI	131	VCOM
27	VCORE	62	DB<3>	97	VCI	132	VCOM
28	VCORE	63	DB<2>	98	VCI1	133	NULL
29	VCORE	64	DB<1>	99	VCI1	134	DUMMY
30	VCORE	65	DB<0>	100	VCI1		
31	VCORE	66	SDA	101	C11M		
32	VCORE	67	DOTCLK	102	C11M		
33	VDDI	68	ENABLE	103	C11M		
34	VDDI	69	HSYNC	104	C11P		
35	VDDI	70	VSYNC	105	C11P		

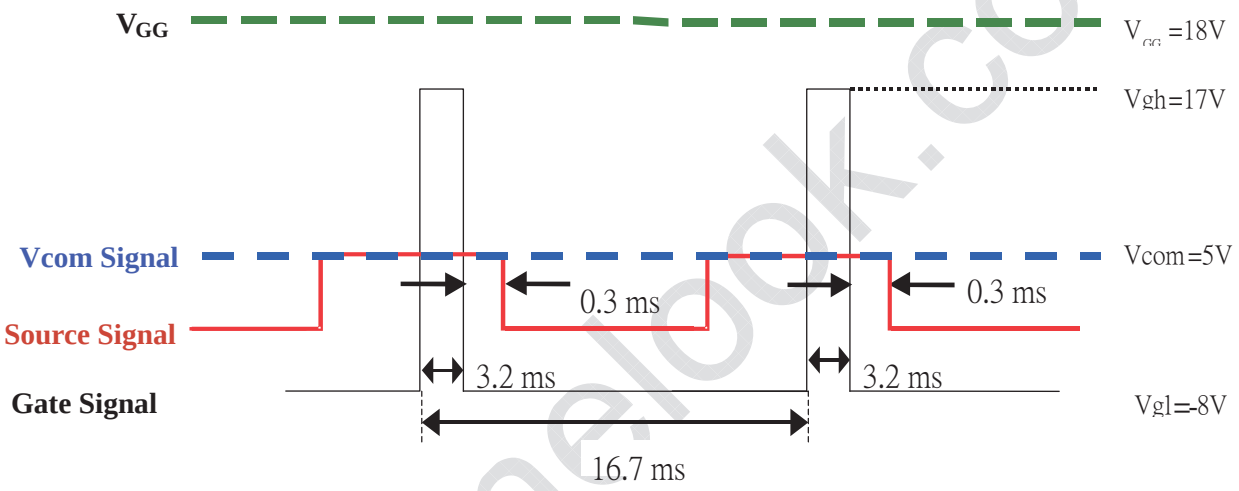
3.2 TFT Design Rules

Item		Specification	unit
COG ILITEK ILI9341 or compatible	Chip size	15.87 x 0.65	mm
	Pad number	1278	
	Pin assignment	Based on the ILI9341 Spec.	
COG HIMAX HX8347G or compatible	Chip size	15.26 x 0.72	mm
	Pad number	1278	
	Pin assignment	Based on the HX8347G Spec.	

3.3 Cell Test Light On Waveform

Display	Vdata	Pattern
Black	TSR = 0V and 11V TSG = 0V and 11V TSB = 0V and 11V	
Gray	TSR = 0V and 6V TSG = 0V and 6V TSB = 0V and 6V	
Red	TSR =5V and 6V TSG = 0V and 11V TSB = 0V and 11V	
Green	TSR = 0V and 11V TSG = 5V and 6V TSB = 0V and 11V	
Blue	TSR = 0V and 11V TSG = 0V and 11V TSB = 5V and 6V	

Testing Waveform-



Vdata= 0V and 5V

4.0 OPTICAL CHARACTERISTICS

HSD024B3N5-D10 (for special customer)

4.1 Optical Specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (without Polarizer)		T(%)	–	12.8	14.3	–	%	
Transmittance (with Polarizer)		T(%)	–	4.6	5.2	–	%	Measuring with normal polarizer，Reference Only
Contrast Ratio		CR	Θ=0 Normal viewing angle	400	500	–	–	(1)(2)
Response Time	Rising	T_R		–	4	8	msec	Response Time
	Falling	T_F		–	12	24		
Color Gamut		S(%)		51	60		%	
Color Chromaticity (CIE1931)	White	W_x		0.283	0.303	0.323		Color Chromaticity (CIE1931)
		Wy		0.305	0.325	0.345		
	Red	Rx		0.606	0.626	0.646		
		Ry		0.314	0.334	0.354		
	Green	Gx		0.257	0.277	0.297		
		Gy		0.529	0.549	0.569		
	Blue	Bx		0.122	0.142	0.162		
		By		0.102	0.122	0.142		
Viewing Angle	Hor.	$Θ_L$	CR>10	35	45	–		Viewing Angle
		$Θ_R$		35	45	–		
	Ver.	$Θ_U$		35	45	–		
		$Θ_D$		10	20	–		
Optima View Direction		12 O'clock						(5)

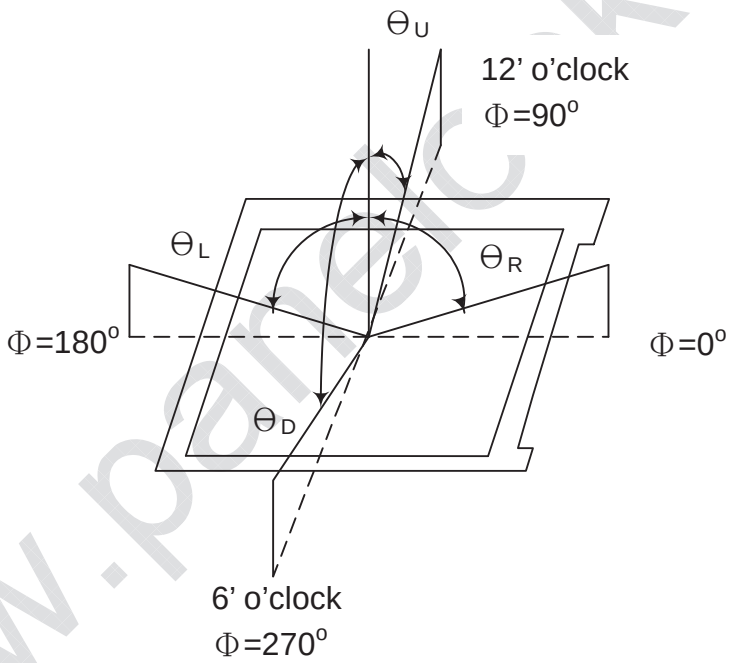
4.2 Measuring Condition

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

4.3 Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

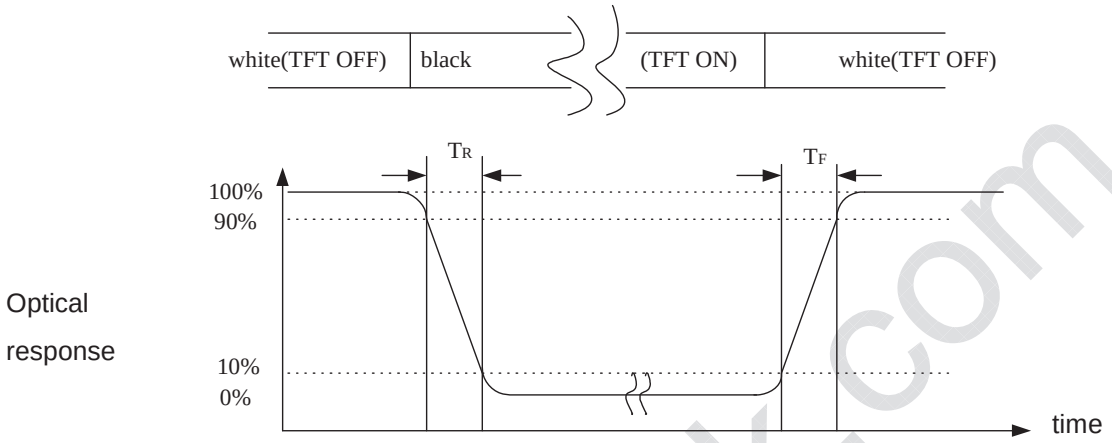
Note (1) Definition of Viewing Angle:



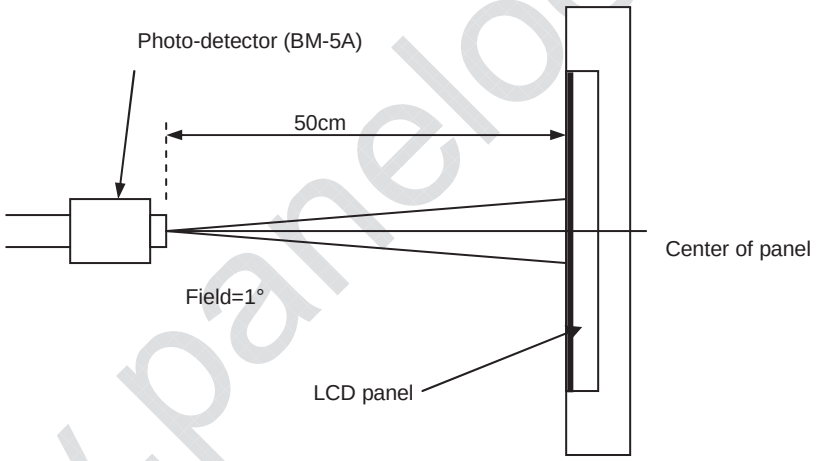
Note (2) Definition of Contrast Ratio (CR):
measured at the center point of panel

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

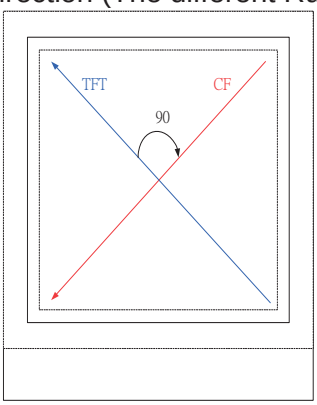
Note (3) Definition of Response Time: Sum of T_R and T_F



Note (4) Definition of optical measurement setup

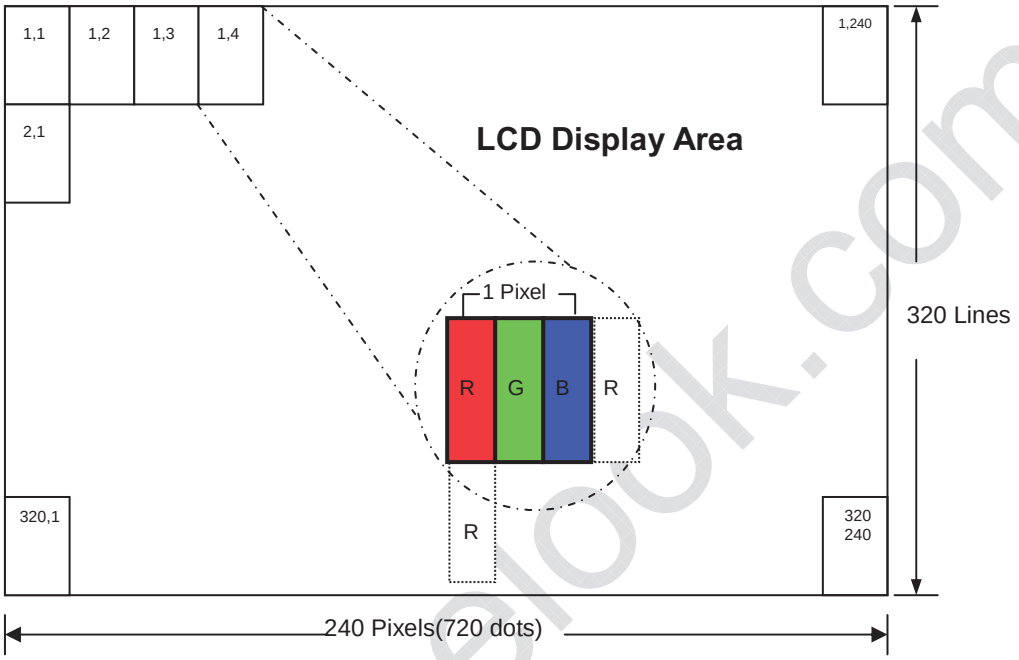


Note (5) Rubbing Direction (The different Rubbing Direction will cause the different view direction.



TFT Face up

5.0 PIXEL FORMAT

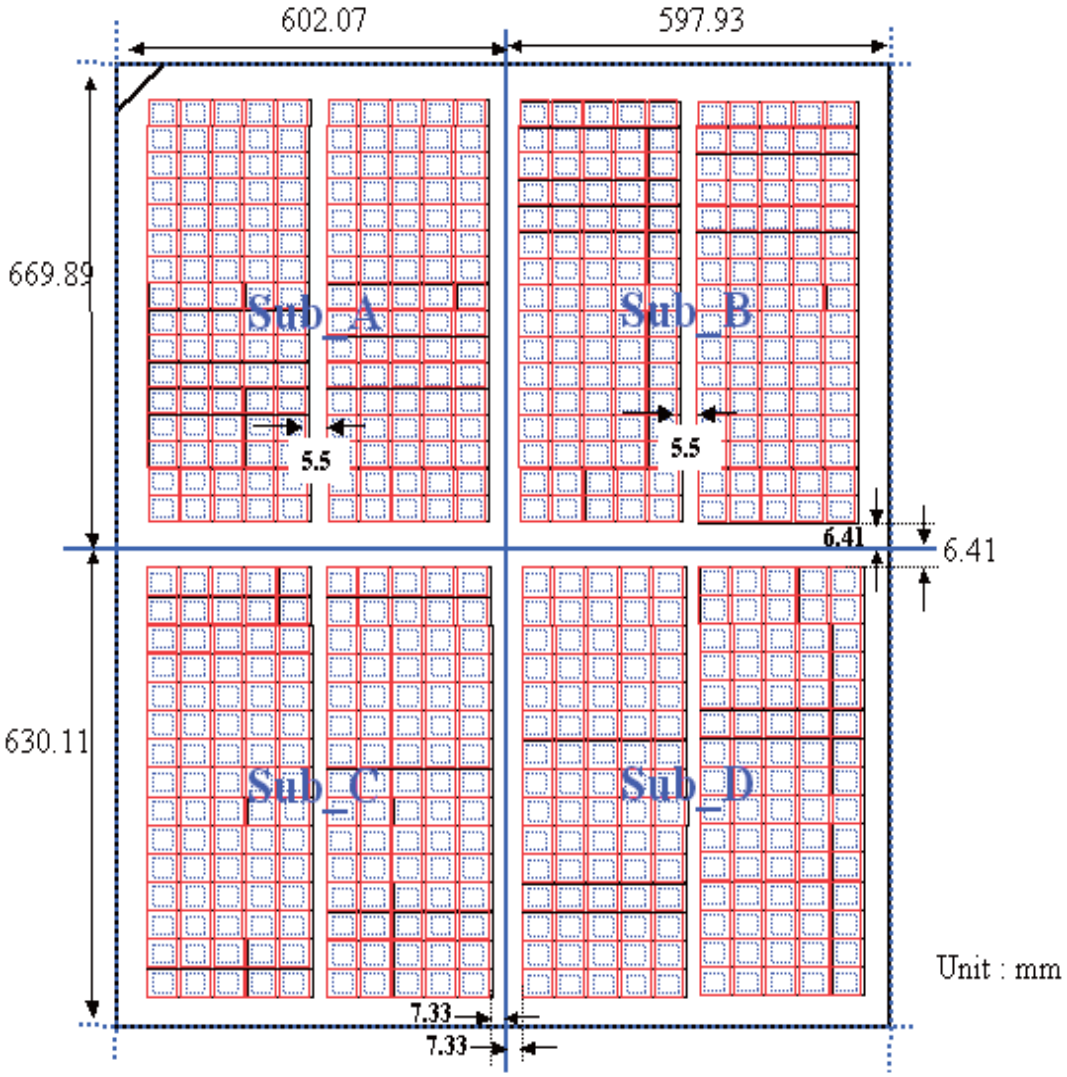


6.0 OUTLINE DIMENSION

Unit : mm

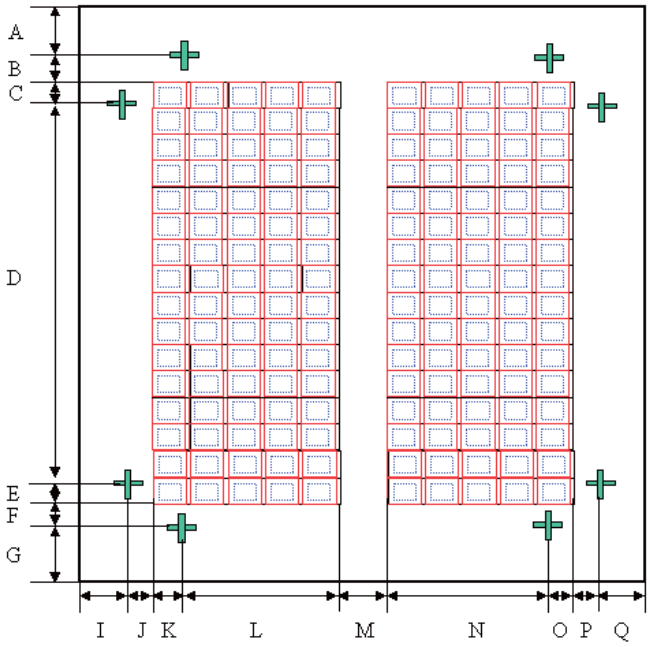
6.1 Outline Dimension of Mother Glass

For TFT film up

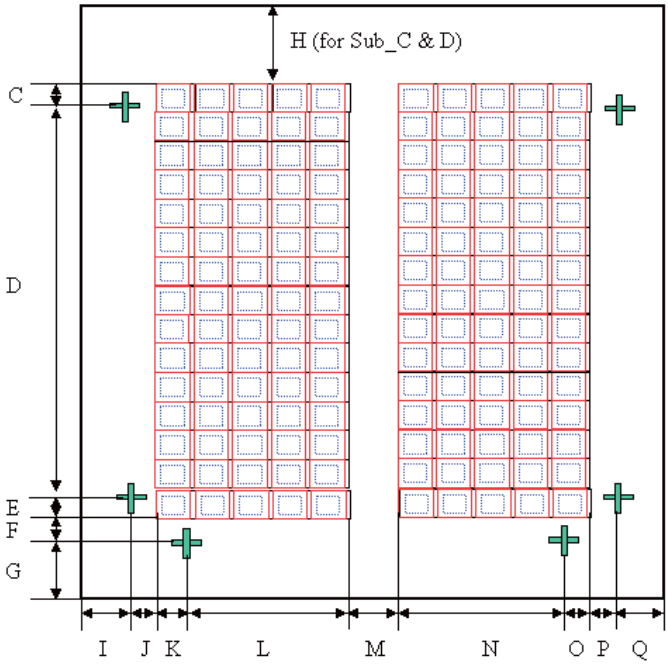


6.2 Chip Cut Mark Position

Sub A/B Array Film Up

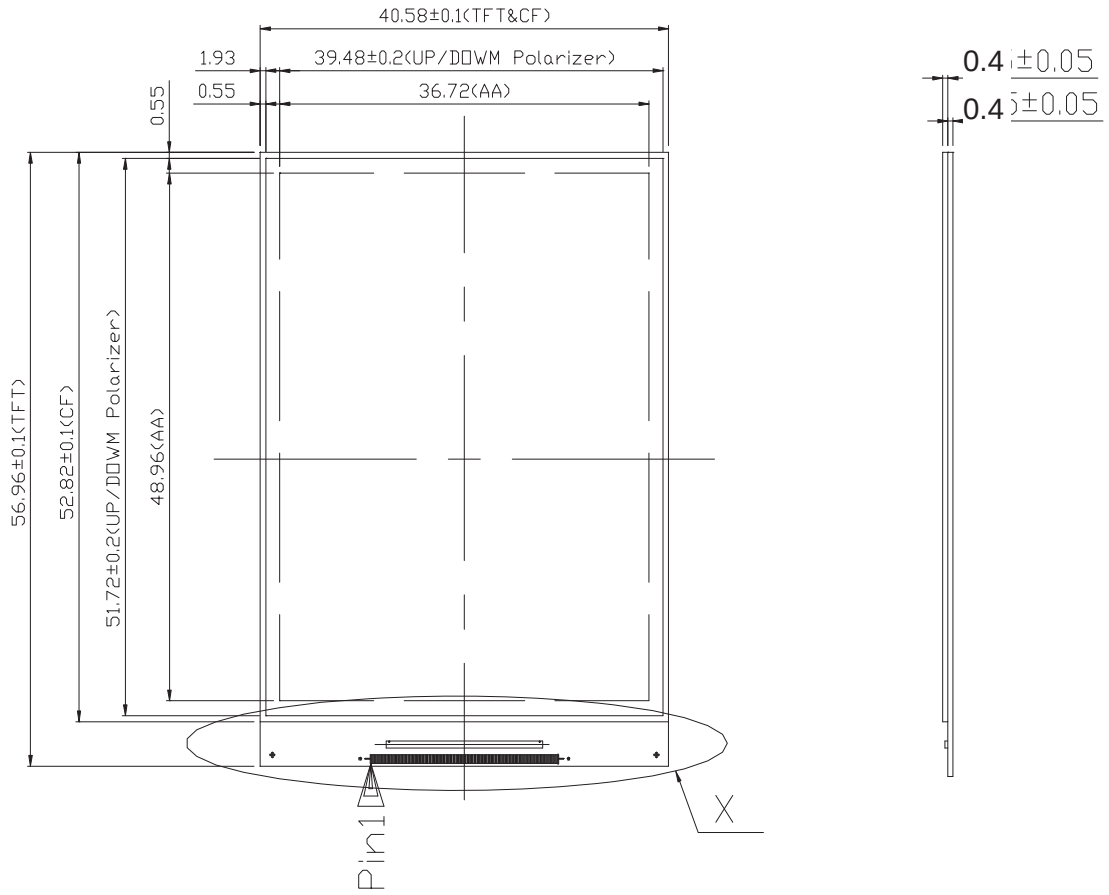


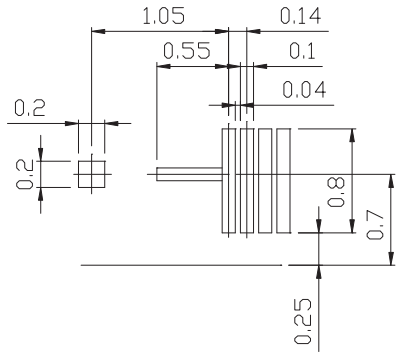
Sub C/D Array Film Up



	Sub A	Sub B	Sub C	Sub D
A	12.7	12.7	--	--
B	1.5	1.5	--	--
C	9.79	9.79	50.37	50.37
D	608.7	608.7	527.54	527.54
E	30.79	30.79	30.79	30.79
F	1.5	1.5	1.5	1.5
G	4.91	4.91	13.5	13.5
H	14.2	14.2	6.41	6.41
I	14	5.83	14	5.83
J	1.5	1.5	1.5	1.5
K	3.3	3.3	3.3	3.3
L	281.5	281.5	281.5	281.5
M	5.5	5.5	5.5	5.5
N	231.14	231.14	231.14	231.14
O	53.66	53.66	53.66	53.66
P	1.5	1.5	1.5	1.5
Q	5.83	18.14	5.83	18.14

6.3 Chip Size



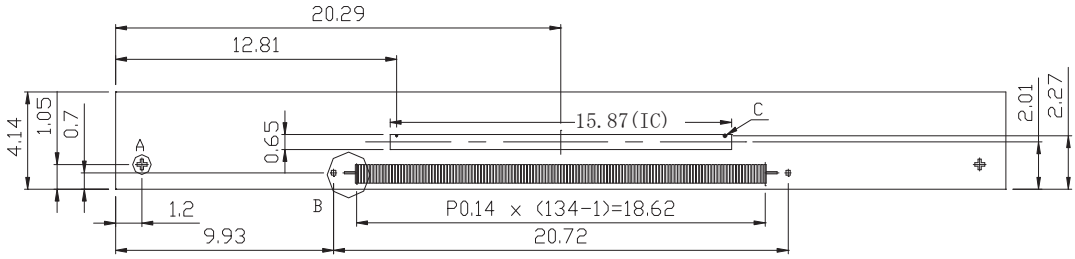


Detail "B" (S=10:1)

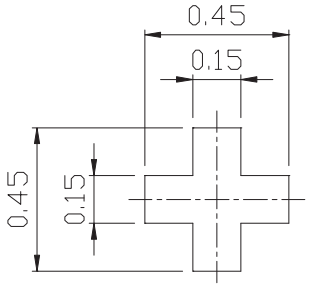
Notes:

1. General Tolerance: ±0.2 2. FPC Pad Tolerance: ± 0.02

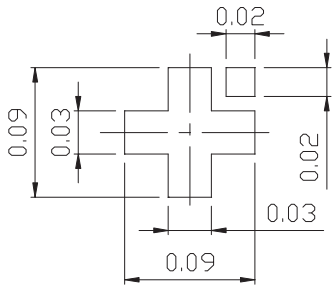
6.4 Driver IC Block Position



Detail "X" (S=2:1)



Detail "A" (S=20:1)

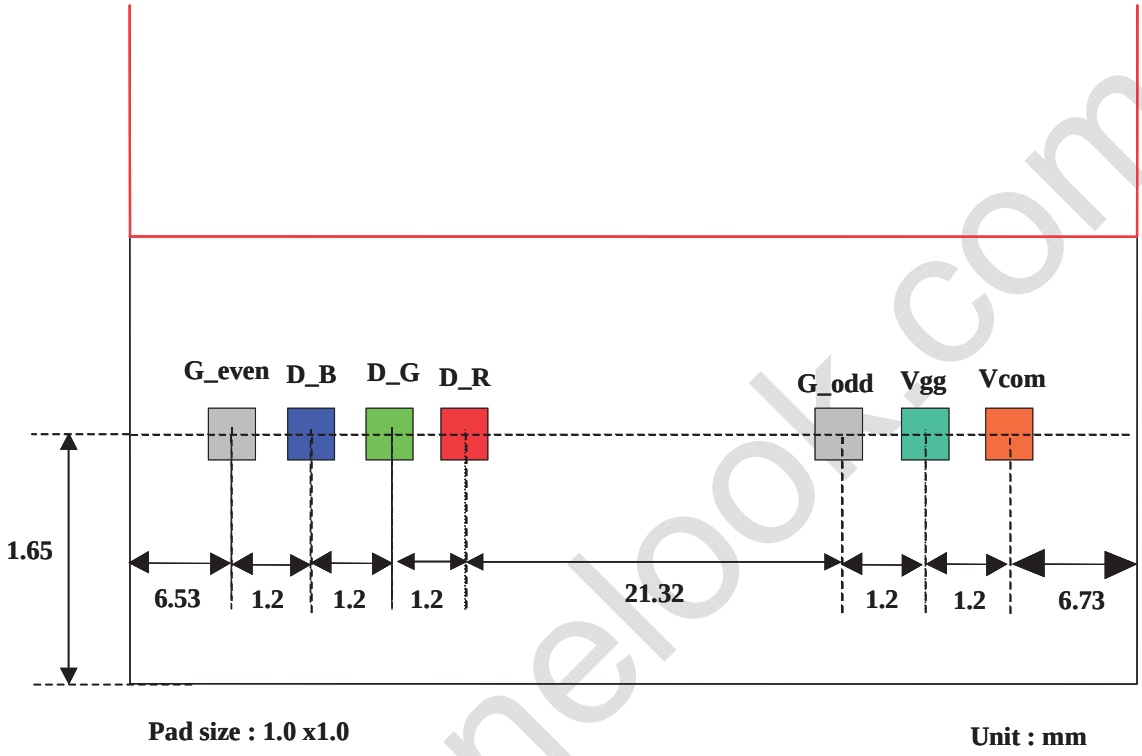


Detail "C" (S=100:1)

Notes:

1. General Tolerance: ±0.2 2. FPC Pad Tolerance: ± 0.02

6.5 Test Pad Position

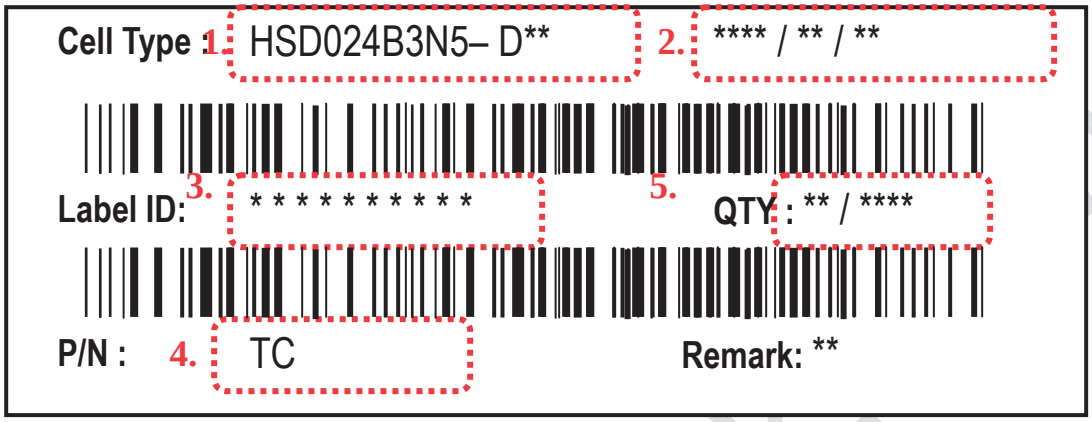


7.0 RELIABILITY TEST ITEMS

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+80°C, 240hrs	
2	Low Temperature Storage	Ta=-30°C, 240hrs	
3	High Temperature Operation	Ta=+70°C, 240hrs	
4	Low Temperature Operation	Ta=-20°C, 240hrs	
5	High Temperature and High Humidity (Operating)	Ta=+60°C, 90%RH, 240hrs	

Note: (1) All tests above are practiced at module type.
(2) There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

8.0 LOT MARK



8.1 Lot Mark

(1) Cell Type: Production name

1	2	3	4	5	6	7	8	9	10	11	12	13	14
H	S	D	0	2	4	B	3	N	5	-	D	*	*

code 1~3: Hannstar Display Co.
code 4~6: Display Area Diagonal size(inch)
011=1.1”
015=1.5”
018=1.8”,……
code 7 : Shipment type
A= Full Size before 2nd cut
B= 1/4 Cut
D= 1/16 Cut
F= Full cell without Polarizer
code 8 : Resolution
1=QQVGA ; 2=QCIF+ ; 3=QVGA ; 4=QQVGA- ;5=960x234 ;
6=480x234/480x240 ; 9=480x272 ; A=240x400/240x432 ;
C=640x234; D=800x480 ; E=SXGA ; F=1024x576/1024x600 ;
G=WXGA+; H=HDTV ;J=720x480; K=WSXGA+ ;S=SVGA ;
X=XGA ; U=WUXGA/FHD ; V=VGA ; W=WXGA ;
code 9 : Aspect ratio
N=Standard , W=Wide
code10 :Serial No.
code12 :Version No.
code13,14 :Reversion No.

(2) Production date

(3) Label ID: serial number for barcode.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

Code (1),(2) : Out source code
Code (3) : Grade (D)
Code (4) : Year

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mark	6	7	8	9	0	1	2	3	4	5

Code (5) : 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

Code (6) : Date (1~9, A~X exp.I/O:10~31)
Code (7),(8),(9),(10) : Serial No.

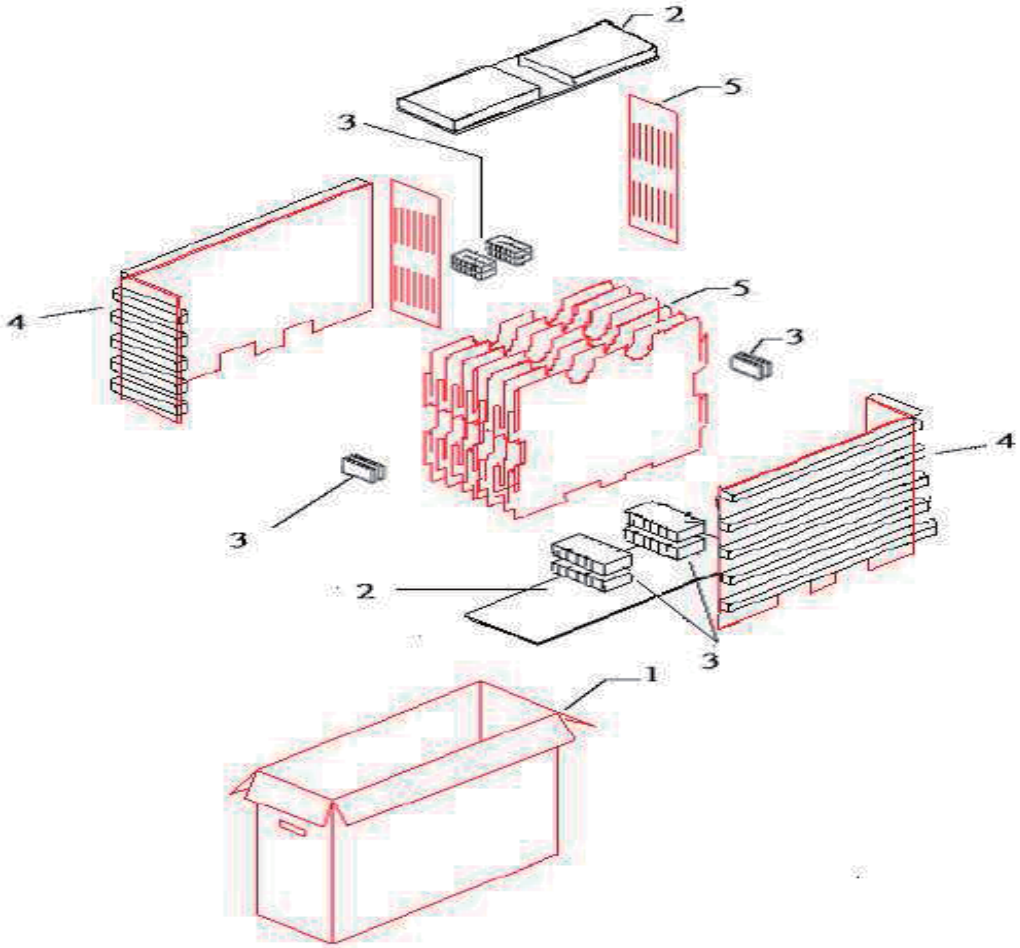
(4) P/N: Hannstar internal part number

(5) QTY: Quantity of chip

9.0 PACKAGE SPECIFICATION

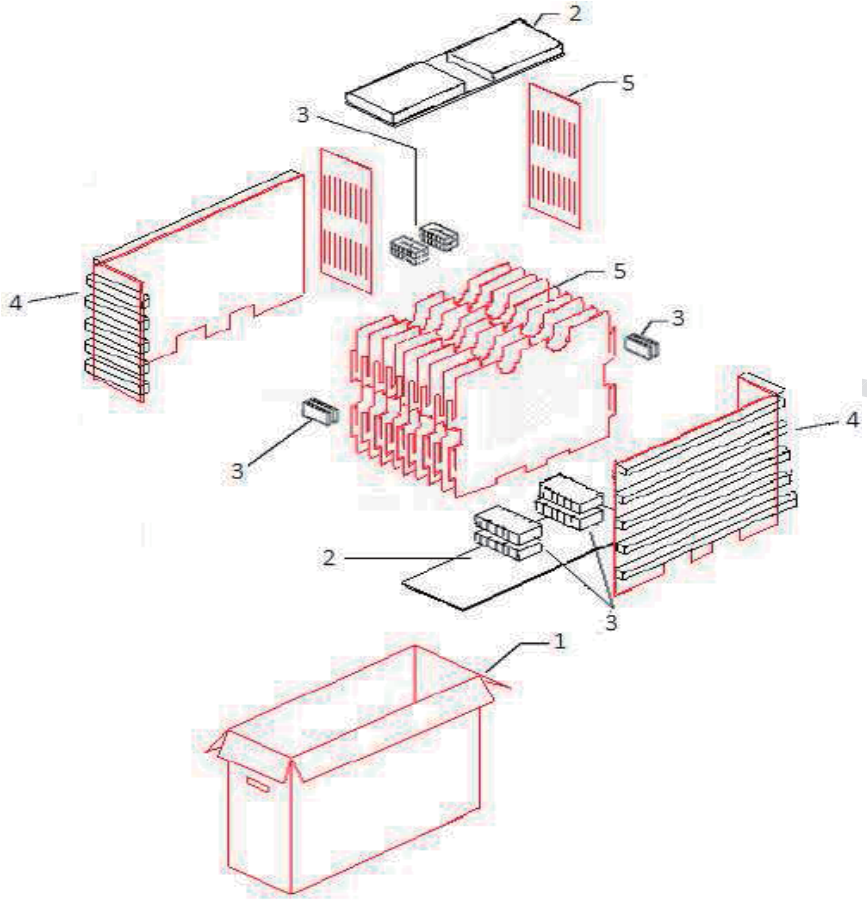
9.1 Packing Form

9.1.1 Packing form For Sub A & Sub B

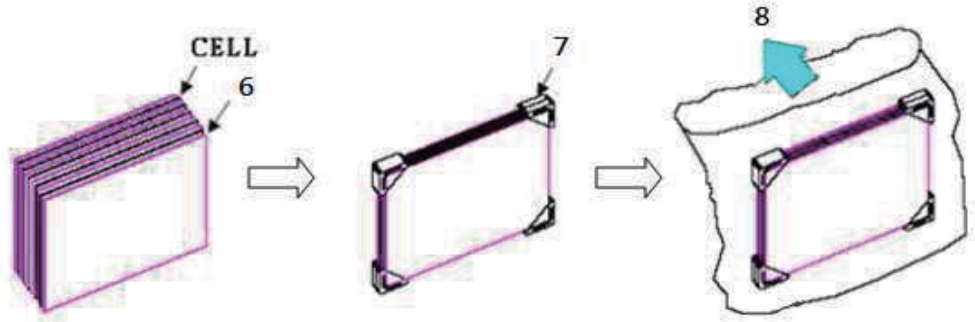


编號	品名	Unit	QTY	附註
1	Carton	PCS	1	
2	EPE Cushion (T/B)	PCS	2	1.EPE Cushion (T)：B楞平板+EPE 片狀 2.EPE Cushion (B)：EPE 片狀
3	EPE Buffer Cushion (T/B & both sides)	PCS	8~12	
4	Around Board=Cardboard + EPE Cushion	PCS	2	B楞平板 +EPE 條狀
5	Cardboard of Partition	Set	1	B楞格隔-A*2pcs B楞格隔-B*7pcs
6	Paper	PCS	48	1 Bag*6pcs
7	Sheath	PCS	32	1 Bag*4pcs
8	Vacuum Bag	PCS	8	

9.1.2 Packing form For Sub C & Sub D



編號	品名	Unit	QTY	附註
1	Carton	PCS	1	
2	EPE Cushion (T/B)	PCS	2	1.EPE Cushion (T)：B 楞平板+ EPE 片狀 2.EPE Cushion (B)：EPE 片狀
3	EPE Buffer Cushion (T/B & both sides)	PCS	8~12	
4	Around Board=Cardboard + EPE Cushion	PCS	2	B 楞平板 + EPE 條狀
5	Cardboard of Partition	Set	1	1.B 楞格組-A*2pcs 2.B 楞格組-B*9pcs
6	Paper	PCS	60	1 Bag*6pcs
7	Sheath	PCS	40	1 Bag*4pcs
8	Vacuum Bag	PCS	10	



Cell 產品與產品中間
須放置 1pcs Paper

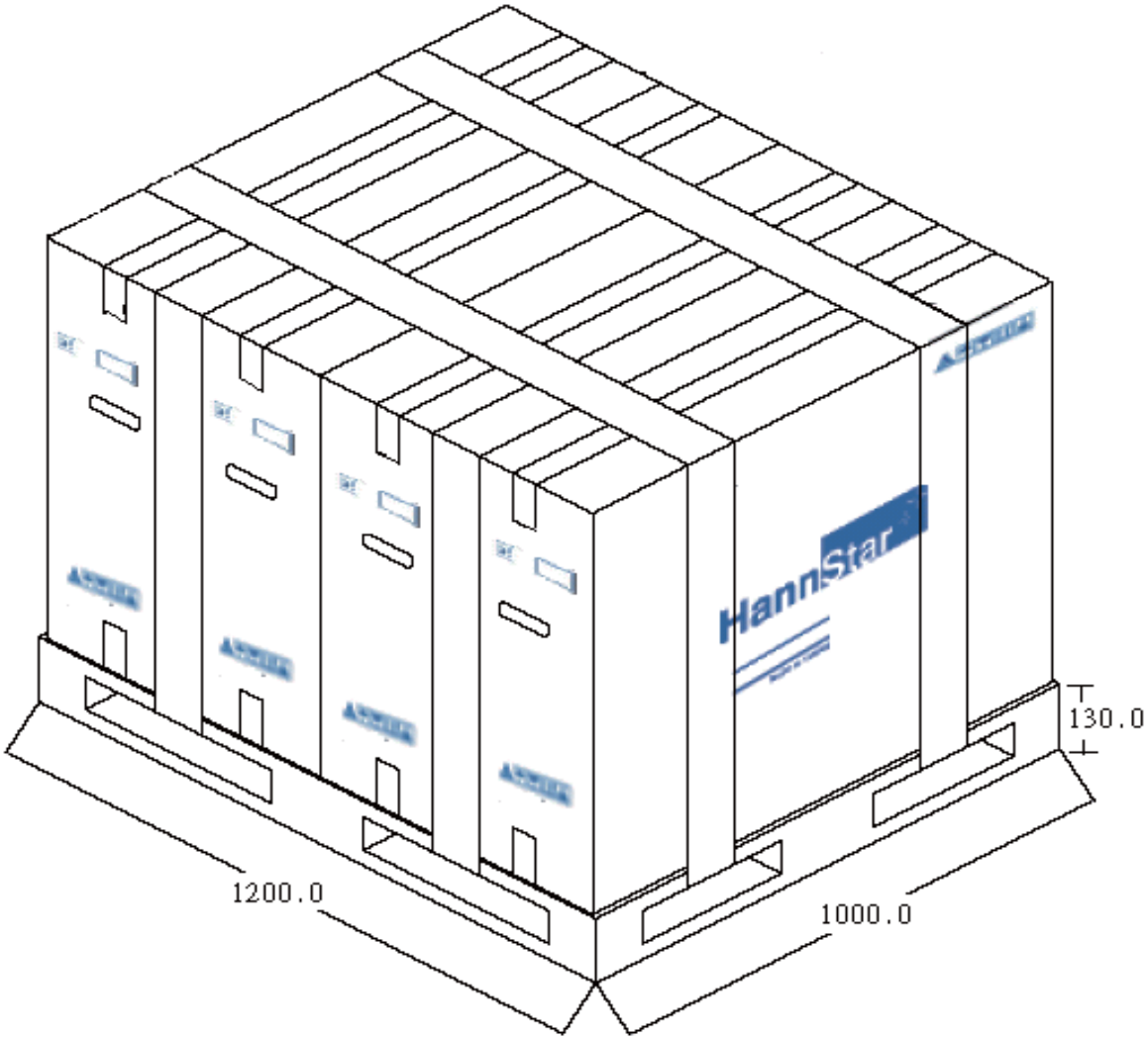
四角套上護角套

放入真空袋內

5 sheets x 10 packs = 50 sheets

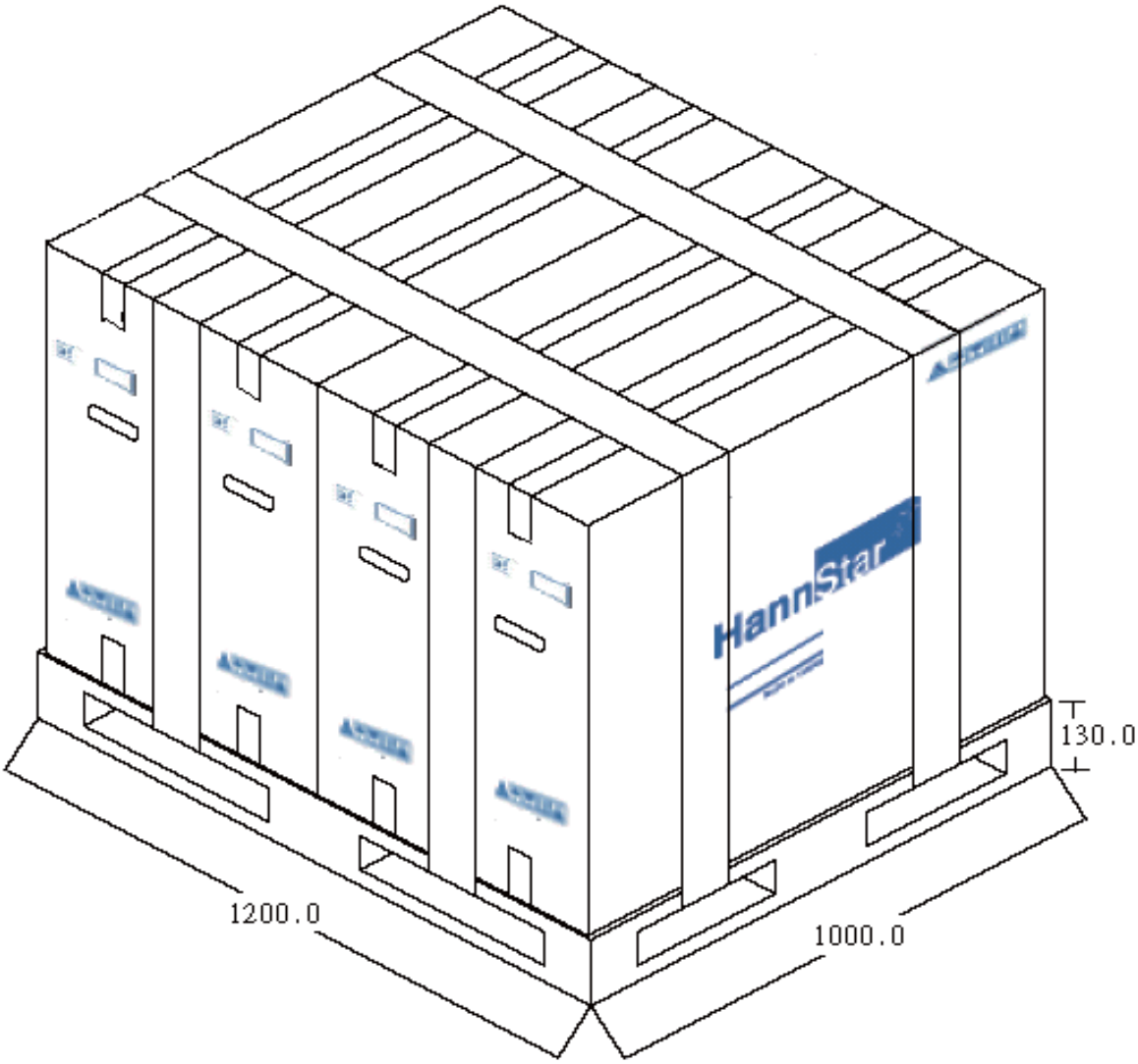
9.2 Packing Assembly Drawings

9.2.1 Packing assembly drawings For Sub A & Sub B



Notes:
1 Pallet: 4 set Cartons
1 Pallet: 160 sheet Cells

9.2.2 Packing assembly drawings For Sub C & Sub D



Notes:
1 Pallet: 4 set Cartons
1 Pallet: 200 sheet Cells

10.0 GENERAL PRECAUTION

10.1 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.

10.2 Disassembling or Modification

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

10.3 Breakage of LCD Panel

10.3.1 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.

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

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

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

10.4 Absolute Maximum Ratings and Power Protection Circuit

10.4.1 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 may be damaged.

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

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

10.5 Operation

10.5.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead If the LCD attaches a polarizer.

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

10.5.3 When the surface is dusty, please wipe gently with absorbent cotton or other softmaterial.

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

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

10.6 Static Electricity

10.6.1 Protection film must remove very slowly from the surface of LCD to prevent from electrostatic occurrence if the LCD attaches a polarizer.

10.6.2 Because TFT-LCD panel is very weak to electrostatic discharge, please be careful with electrostatic discharge.

Persons who handle the LCD should be grounded through adequate methods.

10.7 Strong Light Exposure

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

10.8 Disposal

When disposing LCD, obey the local environmental regulations.

HSD024B3N5-D10

4.1 Optical Specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T(%)	—	4.6	5.2	—	—	Measuring with Polarizer，Reference Only
Transmittance (without Polarizer)		T(%)	—	—	14.3	—	—	
Contrast Ratio		CR	Θ=0 Normal viewing angle	400	500	—	—	(1)(2)
Response time	Rising	T_R		—	4	8	msec	(1)(3)
	Falling	T_F		—	12	24		
Color gamut		S(%)			60		%	
Color chromaticity (CIE1931)	White	W_x		0.283	0.303	0.323		(1)(4) CF glass (C-light)
		Wy		0.305	0.325	0.345		
	Red	Rx		0.606	0.626	0.646		
		Ry		0.314	0.334	0.354		
	Green	Gx		0.257	0.277	0.297		
		Gy		0.529	0.549	0.569		
	Blue	Bx		0.122	0.142	0.162		
		By		0.102	0.122	0.142		
Viewing angle	Hor.	$Θ_L$	CR>10	35	45	—		
		$Θ_R$		35	45	—		
	Ver.	$Θ_U$		35	45	—		
		$Θ_D$		10	20	—		
Optima View Direction		12 O'clock						(5)

3.0 ELECTRICAL SPECIFICATIONS (For special customer)

Item	Symbol	Min.	Typ.	Max.	Unit	Note
TFT Gate ON Voltage	VGH	14	15	16	V	*1,*2
TFT Gate OFF Voltage	VGL	--8.5	-7.5	-6.5	V	
TFT Common Voltage	Vcom	-1.5	--	3.5	V	
Data (RGB signal) Voltage	Vsig	0.2	--	5.2	V	

HSD024B3N5-D10 (for special customer)

4.1 Optical Specification

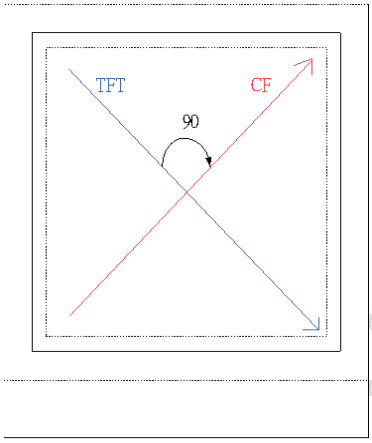
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (without Polarizer)		T(%)	—	12.8	14.3	—	%	
Transmittance (with Polarizer)		T(%)	—	4.6	5.2	—	%	Measuring with normal polarizer，Reference Only
Contrast Ratio		CR	Θ=0 Normal viewing angle	400	500	—	—	(1)(2)
Response Time	Rising	T_R		—	4	8	msec	(1)(3)
	Falling	T_F		—	12	24		
Color Gamut		S(%)		51	60		%	
Color Chromaticity (CIE1931)	White	W_x		0.283	0.303	0.323		(1)(4) CF glass (C-light)
		Wy		0.305	0.325	0.345		
	Red	Rx		0.606	0.626	0.646		
		Ry		0.314	0.334	0.354		
	Green	Gx		0.257	0.277	0.297		
		Gy		0.529	0.549	0.569		
	Blue	Bx		0.122	0.142	0.162		
		By		0.102	0.122	0.142		
Viewing Angle	Hor.	$Θ_L$	CR>10	35	45	—		
		$Θ_R$		35	45	—		
	Ver.	$Θ_U$		35	45	—		
		$Θ_D$		10	20	—		
Optima View Direction		12 O'clock						(5)

HSD024B3N5-D20 (for special customer)

4.1 Optical Specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (without Polarizer)		T(%)	—	12.8	14.3	—	%	
Transmittance (with Polarizer)		T(%)	—	4.6	5.2	—	%	Measuring with normal polarizer，Reference Only
Contrast Ratio		CR	Θ=0 Normal viewing angle	400	500	—	—	(1)(2)
Response Time	Rising	T_R		—	4	8	msec	(1)(3)
	Falling	T_F		—	12	24		
Color Gamut		S(%)		51	60		%	
Color Chromaticity (CIE1931)	White	W_x		0.283	0.303	0.323		(1)(4) CF glass (C-light)
		Wy		0.305	0.325	0.345		
	Red	Rx		0.606	0.626	0.646		
		Ry		0.314	0.334	0.354		
	Green	Gx		0.257	0.277	0.297		
		Gy		0.529	0.549	0.569		
	Blue	Bx		0.122	0.142	0.162		
		By		0.102	0.122	0.142		
Viewing Angle	Hor.	$Θ_L$	CR>10	35	45	—		
		$Θ_R$		35	45	—		
	Ver.	$Θ_U$		10	20	—		
		$Θ_D$		35	45	—		
Optima View Direction		6 O'clock						(5)

Note (5) Rubbing Direction (The different Rubbing Direction will cause the different view direction.



TFT Face up