HannStar Product Specification

(Preliminary)

Model : HSD013BPF1-D00

(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	May.17,2016	D00	Preliminary specification was first issued.
1.1	May. 27,2016		Update 6.3 Chip Size(P20)
1.2	Jun.,13,2016		Update 6.2 Chip Cut Mark Position
1.3	Sep.,02,2016		Update 3.0 ELECTRICAL SPECIFICATIONS

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD013BPF1-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 black mode.

This TFT LCD has a 1.28-inch diagonally measured active display area with 240 x 240 dot (240 horizontal by 240 vertical pixel) resolution. Each pixel is divided into Red, Green, Blue dots which are arranged in vertical stripes.

1.2 Applications

Smart Watch applications

1.3 General Information

Item	Specification	Unit
Glass Dimension	35.1(H) x 37.83(V) x 0.4(T) (Typ.)	mm
Display Area	Φ32.4	mm
Number of Pixel	240 RGB(H) x 240(V)	pixels
Pixel Pitch	0.135H) x 0.135(V)	mm
Pixel Arrangement	RGB Vertical stripe	
Display Mode	Normally black	
Display Color	262K	

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	--	5.2	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	--	-12	--	V	
TFT Common Voltage	Vcom	-2	--	0	V	
Data (RGB signal) Voltage	Vsig	-5.1	--	5.1	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.

*4. Frame rate suggestion value: 105 Hz

3.1 FPC Pin Assignment

Pad No.	Pad Name	Pad No.	Pad Name
1	GND	31	TE
2	NULL(metal open)	32	DB[17]
3	VCOM	33	DB[16]
4	VCOM	34	DB[15]
5	VCOM	35	DB[14]
6	VCOM/VCOM_R	36	DB[13]
7	VCOM/VCOM_R	37	DB[12]
8	VCOM/VCOM_R	38	DB[11]
9	AGND	39	DB[10]
10	AGND	40	DB[9]
11	AGND	41	DB[8]
12	VGH/VGL(*Note1)	42	DB[7]
13	VGH/VGL(*Note1)	43	DB[6]
14	VGH/VGL(*Note1)	44	DB[5]
15	VPP	45	DB[4]
16	VPP	46	DB[3]
17	VCC/VCORE	47	DB[2]
18	VCC/VCORE	48	DB[1]
19	VCC/VCORE	49	DB[0]
20	VCC/VCORE	50	SDA
21	VCC/VCORE	51	DOTCLK
22	VCC/VCORE	52	ENABLE
23	VDDI/IOVCC	53	HSYNC
24	VDDI/IOVCC	54	VSYNC
25	VDDI/IOVCC	55	RDX
26	VDDI/IOVCC	56	WRX
27	VDDI_LED/DUMMY	57	DCX
28	LED_EN	58	CSX
29	LED_PWM	59	RESX
30	SDO	60	IM[0]

FPC OLB		FPC OLB	
Pad No.	**Pad Name**	**Pad No.**	**Pad Name**
61	IM[1]	91	DUMMY/VGH(*Note2)
62	IM[2]	92	DUMMY/VGH(*Note2)
63	IM[3]	93	VCOM/VCOM_L
64	EXTC	94	VCOM/VCOM_L
65	DGND	95	VCOM/VCOM_L
66	DGND	96	VCOM
67	DGND	97	VCOM
68	AGND	98	VCOM
69	AGND	99	NULL(metal open)
70	AGND	100	GND
71	AGND/CGND		
72	AGND/CGND		
73	AGND/CGND		
74	AGND/VGS		
75	AGND/VGS		
76	VDD/VCI		
77	VDD/VCI		
78	VDD/VCI		
79	VDD/VCI		
80	VAP/VREG1OUT		
81	VAP/VREG1OUT		
82	VAN/VREG2OUT		
83	AVCL/DDVDL		
84	AVCL/DDVDL		
85	AVCL/DDVDL		
86	AVDD/DDVDH		
87	AVDD/DDVDH		
88	AVDD/DDVDH		
89	VGL		
90	VGL		

***Note1: ST7789V & ST7789H2 pin12~14 → VGH**

ILI9340L pin12~14 →VGL

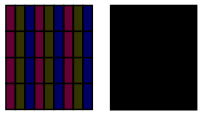
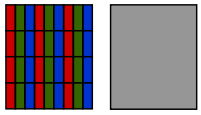
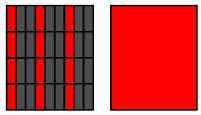
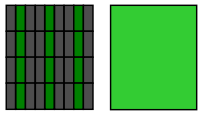
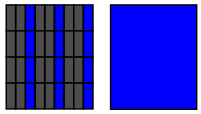
***Note2: ST7789V & ST7789H2 pin91 & 92 → DUMMY**

ILI9340L pin91 & 92 →VGH

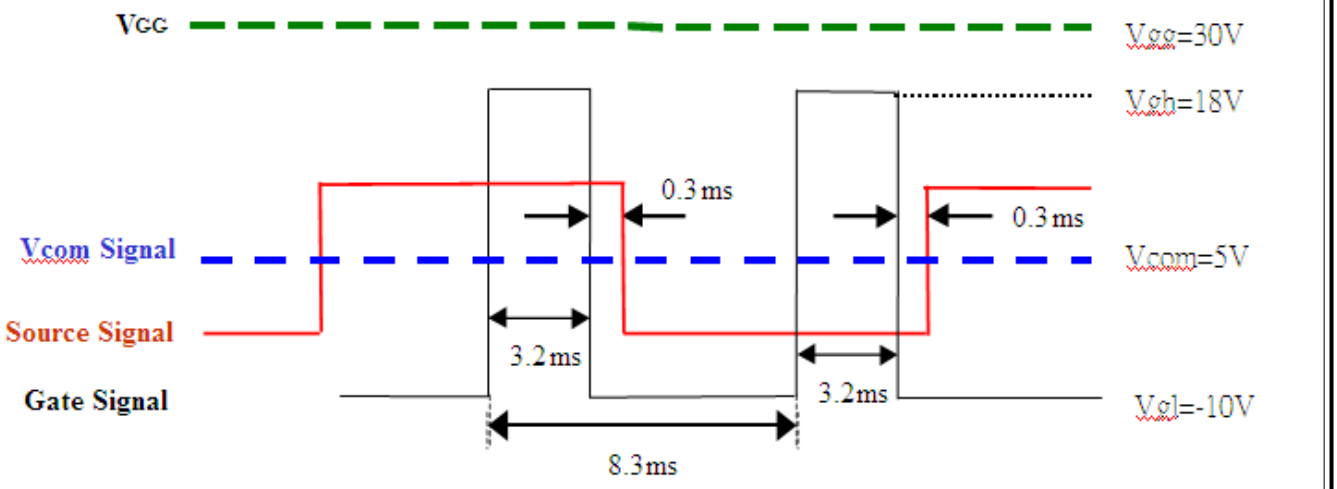
3.2 TFT Design Rules

Item		Specification	unit
ST7789H2	Chip size	15155 x 698	um
	Pad number	1278	
	Pin assignment	Based on the ST7789H2 Spec.	

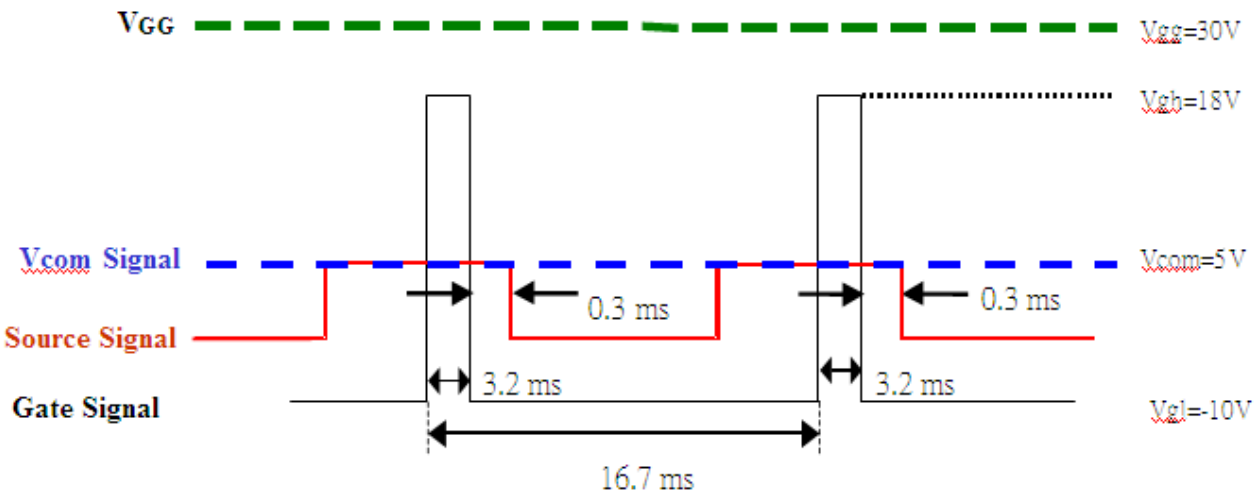
3.3 Cell Test Light On Waveform

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-1

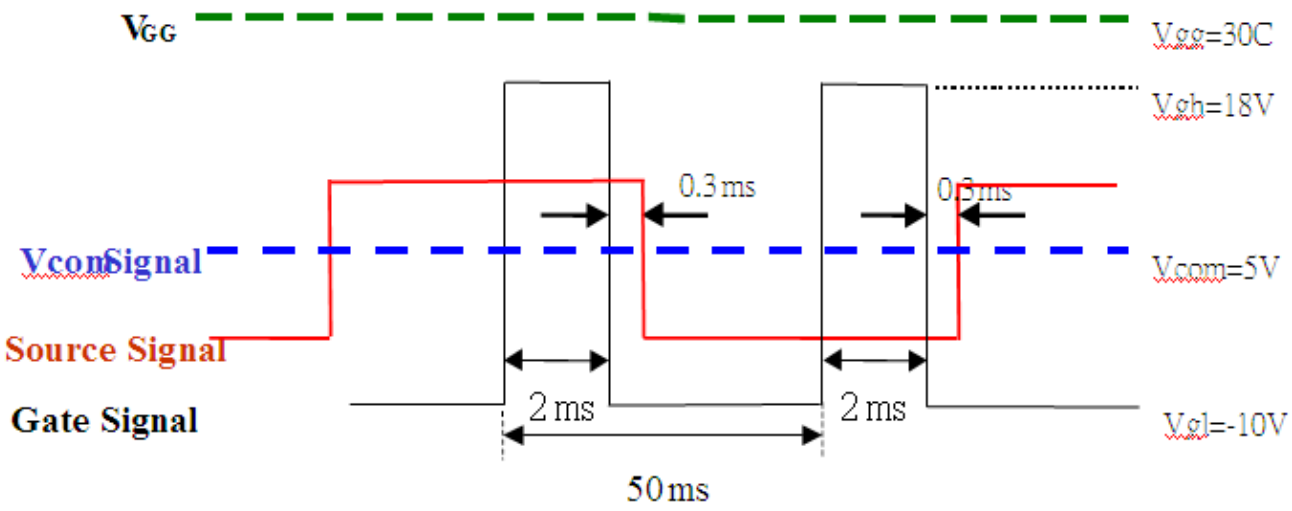


Testing Waveform -2



Vdata= 0V and 5V (White)

Testing Waveform -3



Vdata= 0V and 11V (Low Frequency)

4.0 OPTICAL CHARACTERISTICS

4.1 Optical Specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T(%)	—	--	4.7	—	%	Normal POL
Transmittance (without Polarizer)		T(%)	—	--	15.32	—	%	
Contrast Ratio		CR	Θ=0 Normal viewing angle	640	800	—	—	(1)(2)
Response Time		T_R+T_F		—	30	35	msec	(1)(3)
Color Gamut		S(%)			60	—	%	
Color Chromaticity (CIE1931)	White	W_x		TBD	(0.308)	TBD		(1)(4) CF glass
		Wy		TBD	(0.331)	TBD		
	Red	Rx		TBD	0.641	TBD		
		Ry		TBD	0.337	TBD		
	Green	Gx		TBD	0.274	TBD		
		Gy		TBD	0.560	TBD		
	Blue	Bx		TBD	0.141	TBD		
		By		TBD	0.113	TBD		
Viewing Angle	Hor.	$Θ_L$	CR>10	—	80	—		Viewing Angle base on using Normal Polarizer，Reference Only
		$Θ_R$		—	80	—		
	Ver.	$Θ_U$		—	80	—		
		$Θ_D$		—	80	—		
Optima View Direction		ALL						(5)

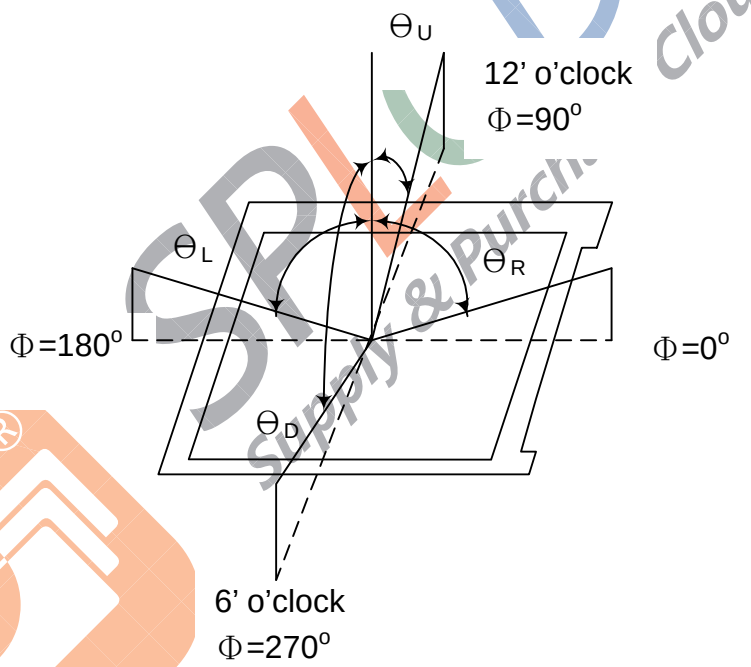
4.2 Measuring Condition

- 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:

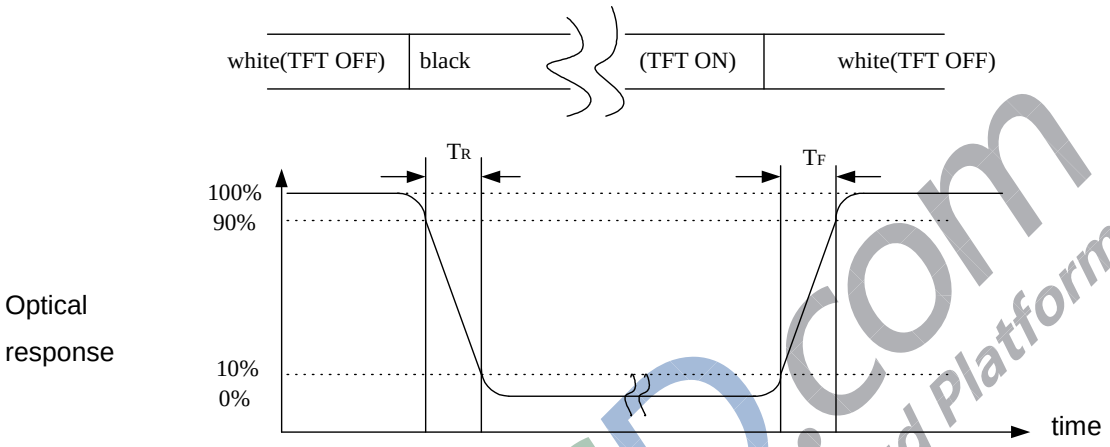


Note (2) Definition of Contrast Ratio (CR):

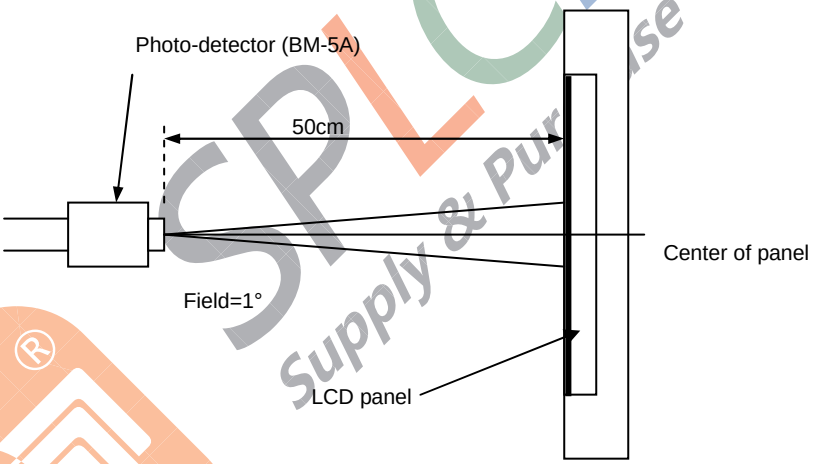
measured at the center point of panel

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

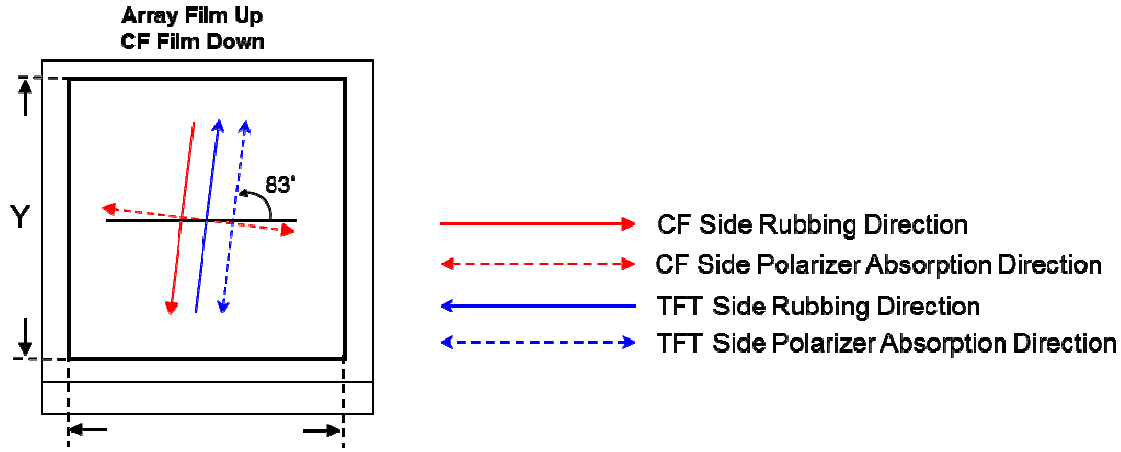
Note (3) Definition of Response Time: Sum of T_R and T_F



Note (4) Definition of optical measurement setup



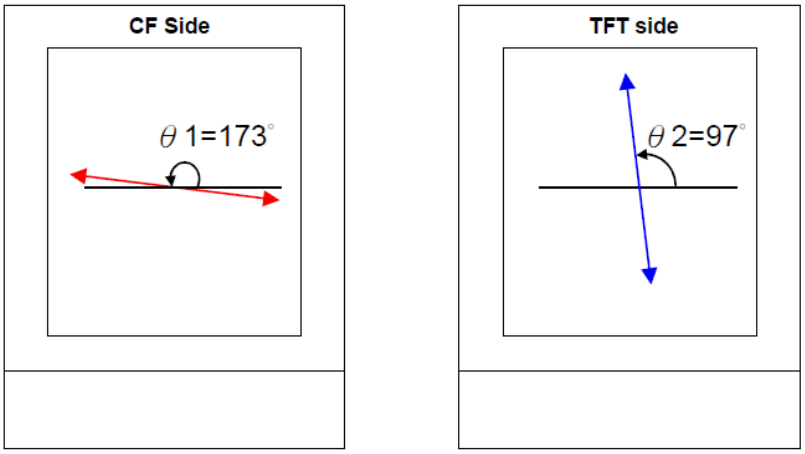
Note (5) Rubbing Direction & Polarizer Absorption Direction

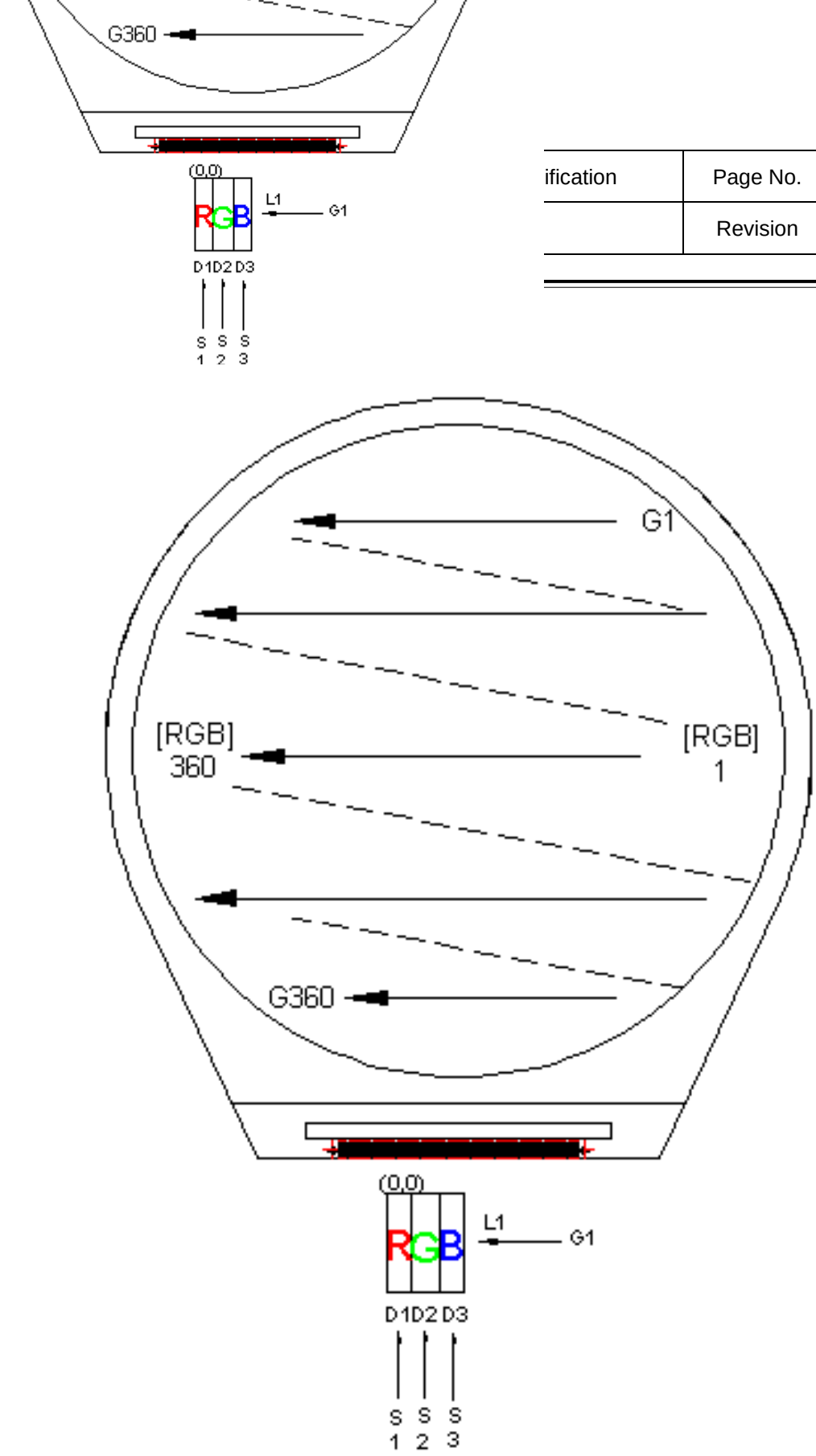


Item	*Specifications*	Unit	Note
Rubbing Direction	*83°(TFT) / 263°(CF)*	degree	1-domain IPS-pro
Absorption axis of Polarizer	*83°(TFT) / 173°(CF)*	degree	Array Film Up CF Film Down

CF side polarizing absorption angle θ 1=173° (Protective film on top, glue layer face down)

TFT side polarizing absorption angle θ 2=97° (Protective film on top, glue layer face down)

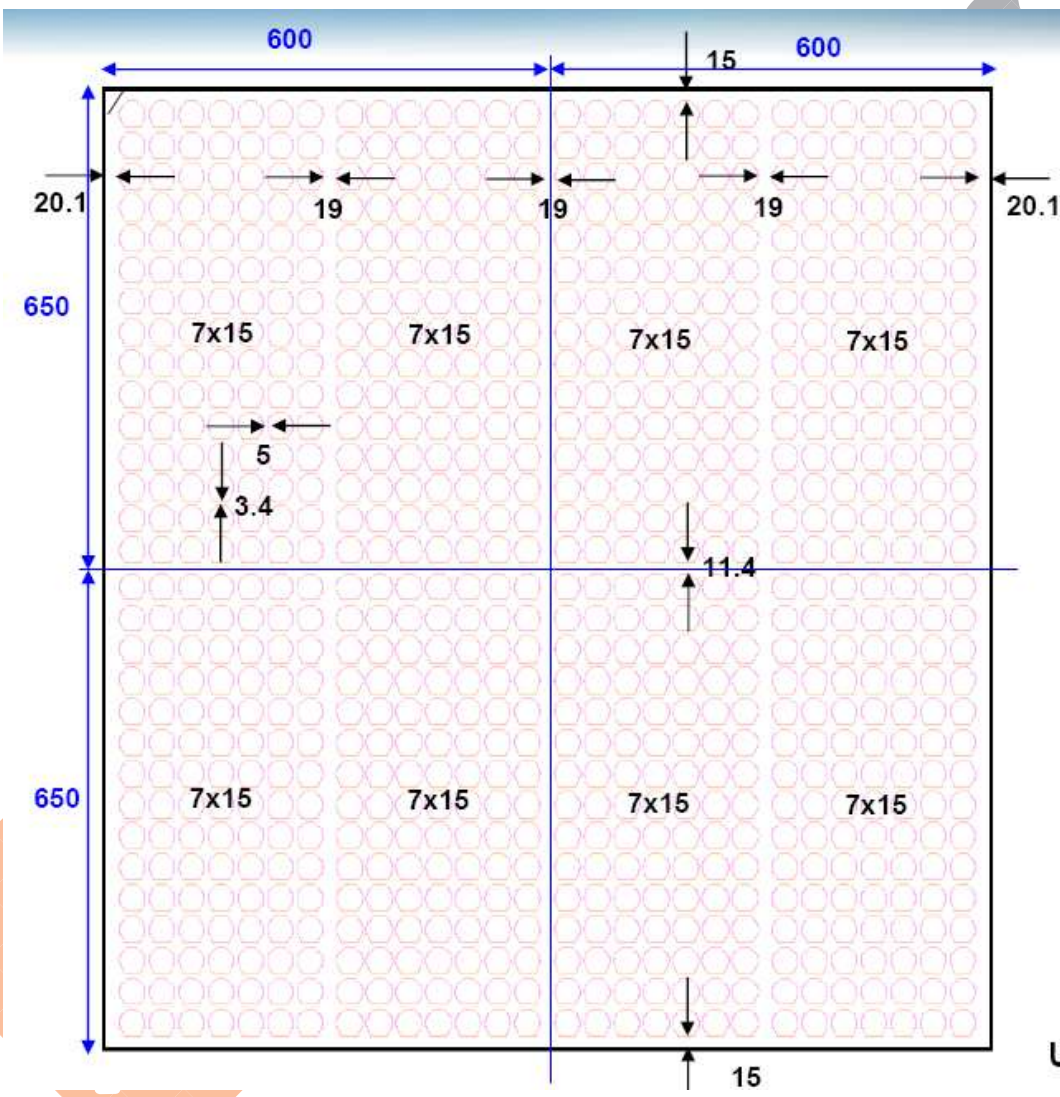




6.0 OUTLINE DIMENSION

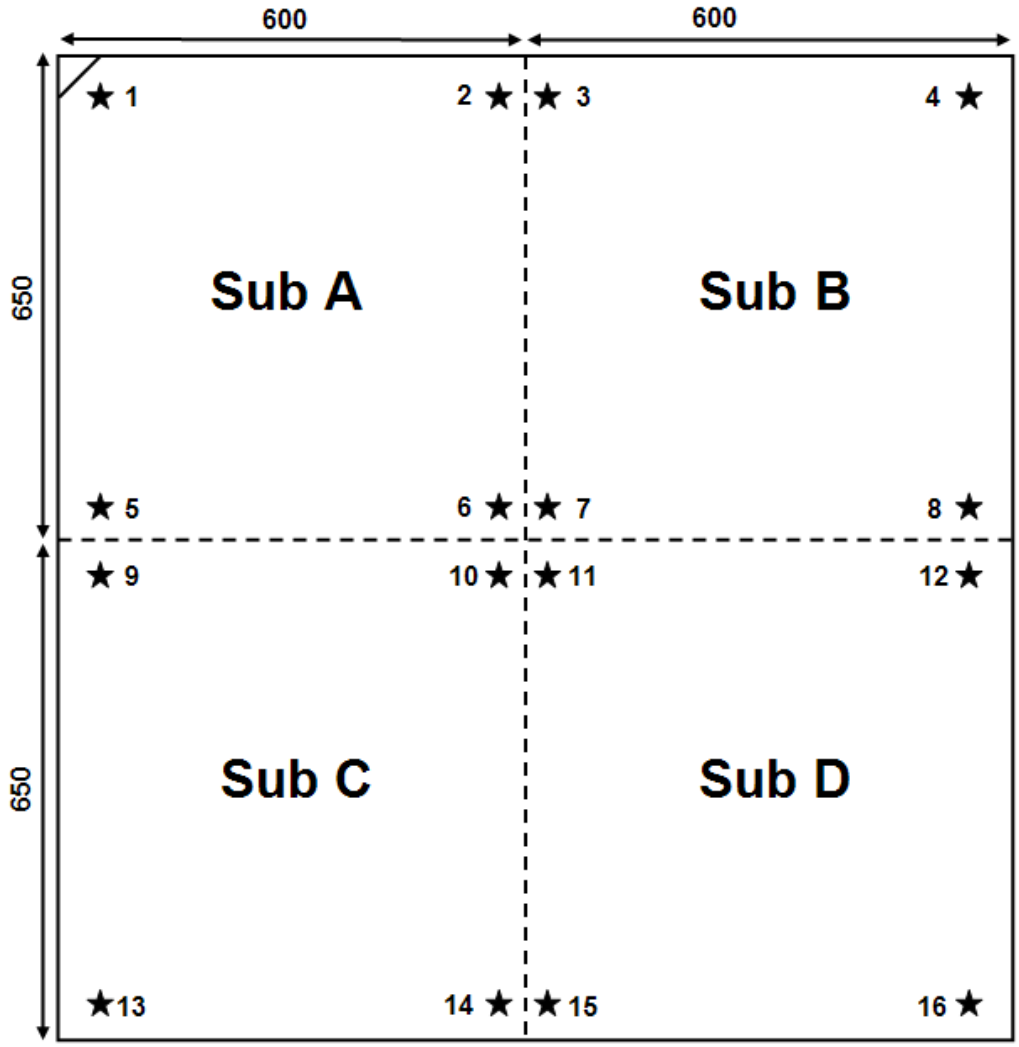
6.1 Outline Dimension of Mother Glass

For TFT film up



6.2 Chip Cut Mark Position

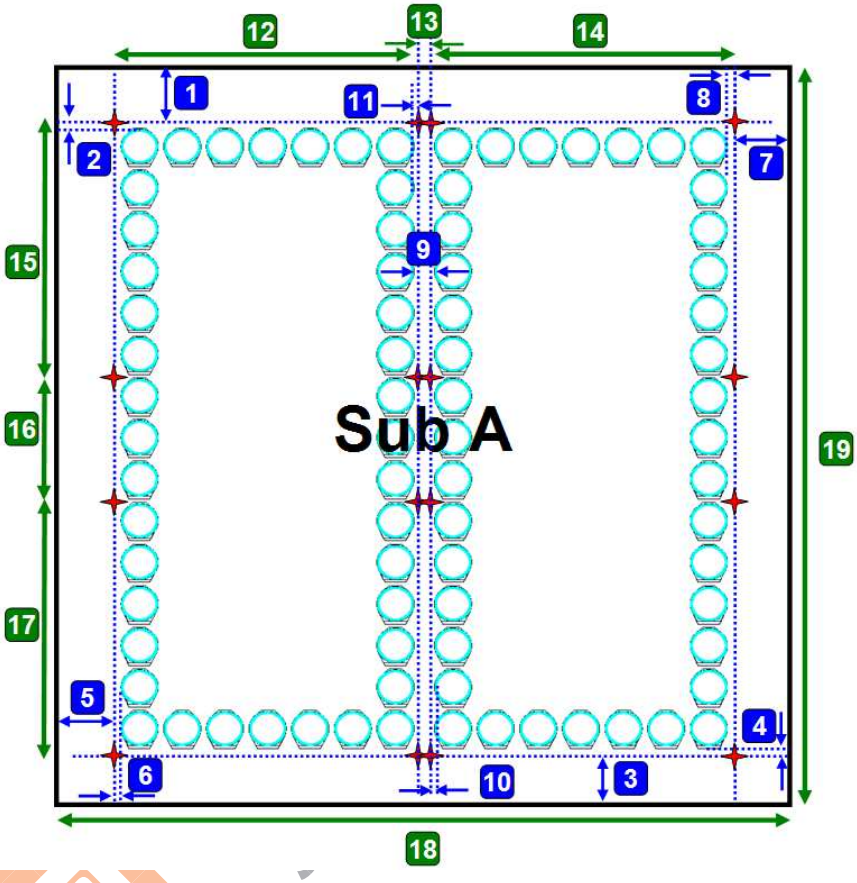
Sub A/B/C/D Array Film Up



Array film up											
No	X	Y	No	X	Y	No	X	Y	No	X	Y
1	-580000	636250	5	-580000	4450	9	-580000	-4450	13	-580000	-636250
2	-9400	636250	6	-9400	4450	10	-9400	-4450	14	-9400	-636250
3	9400	636250	7	9400	4450	11	9400	-4450	15	9400	-636250
4	580000	636250	8	580000	4450	12	580000	-4450	16	580000	-636250

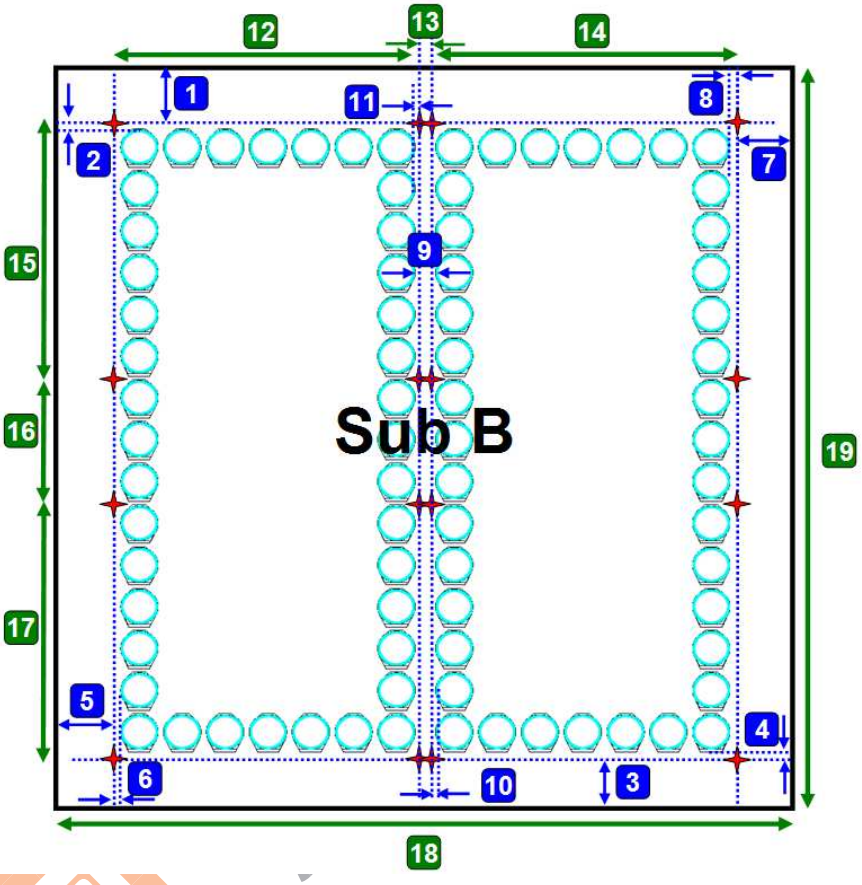
unit : um

Sub A Array Film Up



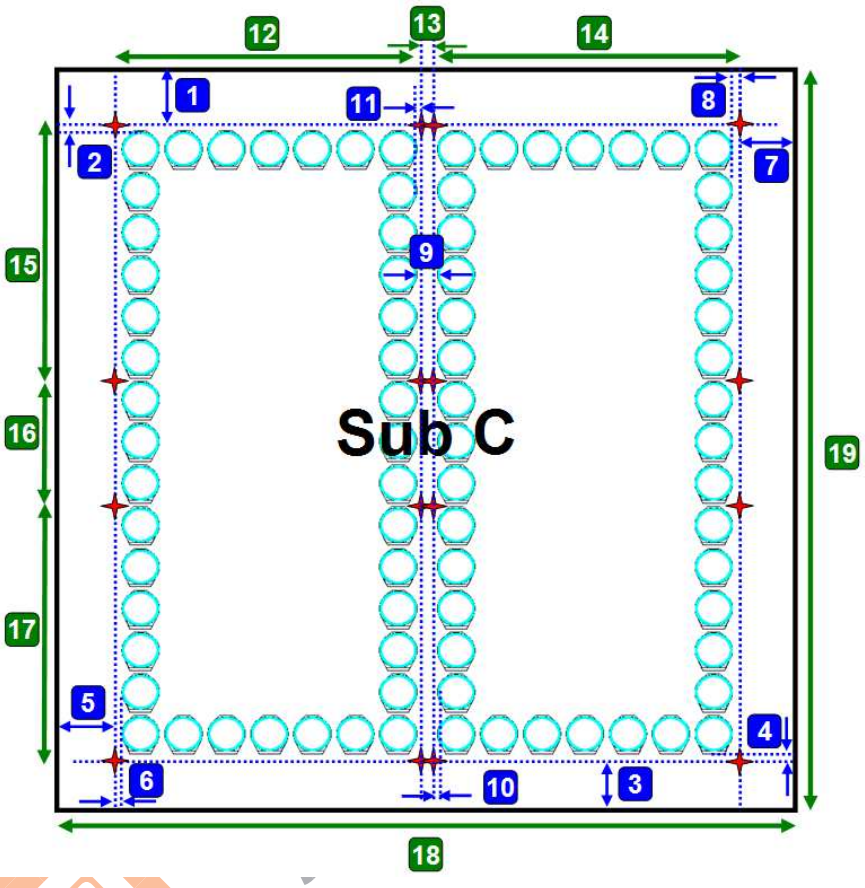
2nd Cutting Distance for 4 up-Sub A			
1	13.75	11	0.1
2	2.2	12	275.9
3	4.45	13	18.8
4	1.25	14	275.9
5	20	15	252.63
6	0.1	16	126.54
7	9.4	17	252.63
8	0.1	18	600
9	19	19	650
10	0.1		
unit：mm			

Sub B Array Film Up



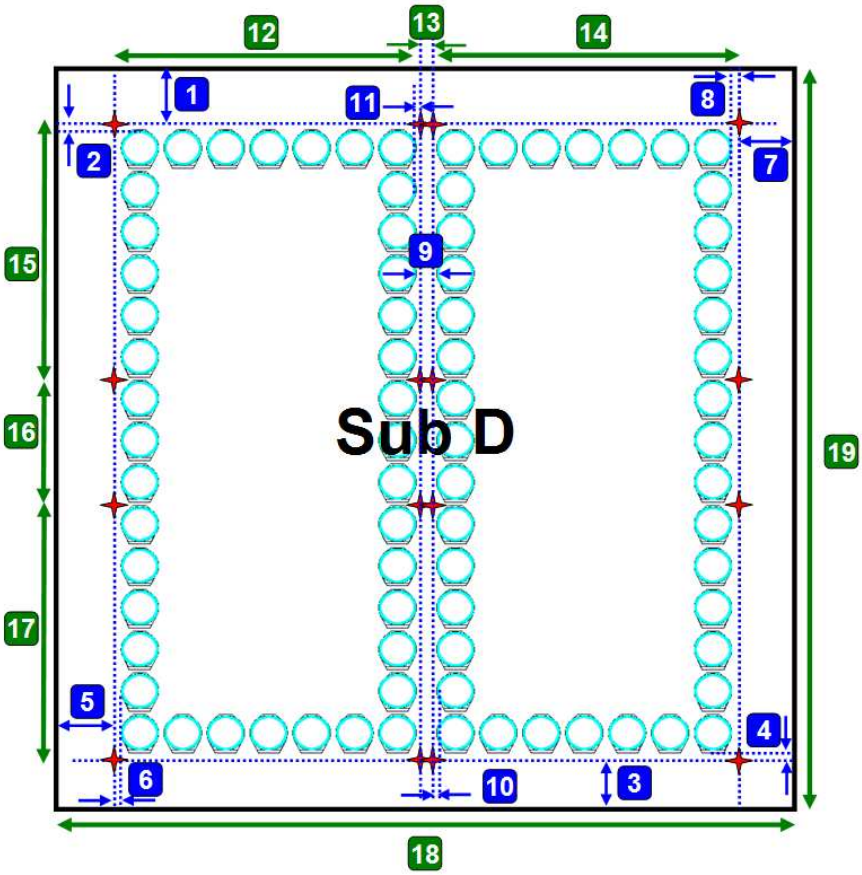
2nd Cutting Distance for 4 up-Sub B			
1	13.75	11	0.1
2	2.2	12	275.9
3	4.45	13	18.8
4	1.25	14	275.9
5	9.4	15	252.63
6	0.1	16	126.54
7	20	17	252.63
8	0.1	18	600
9	19	19	650
10	0.1		
unit：mm			

Sub C Array Film Up



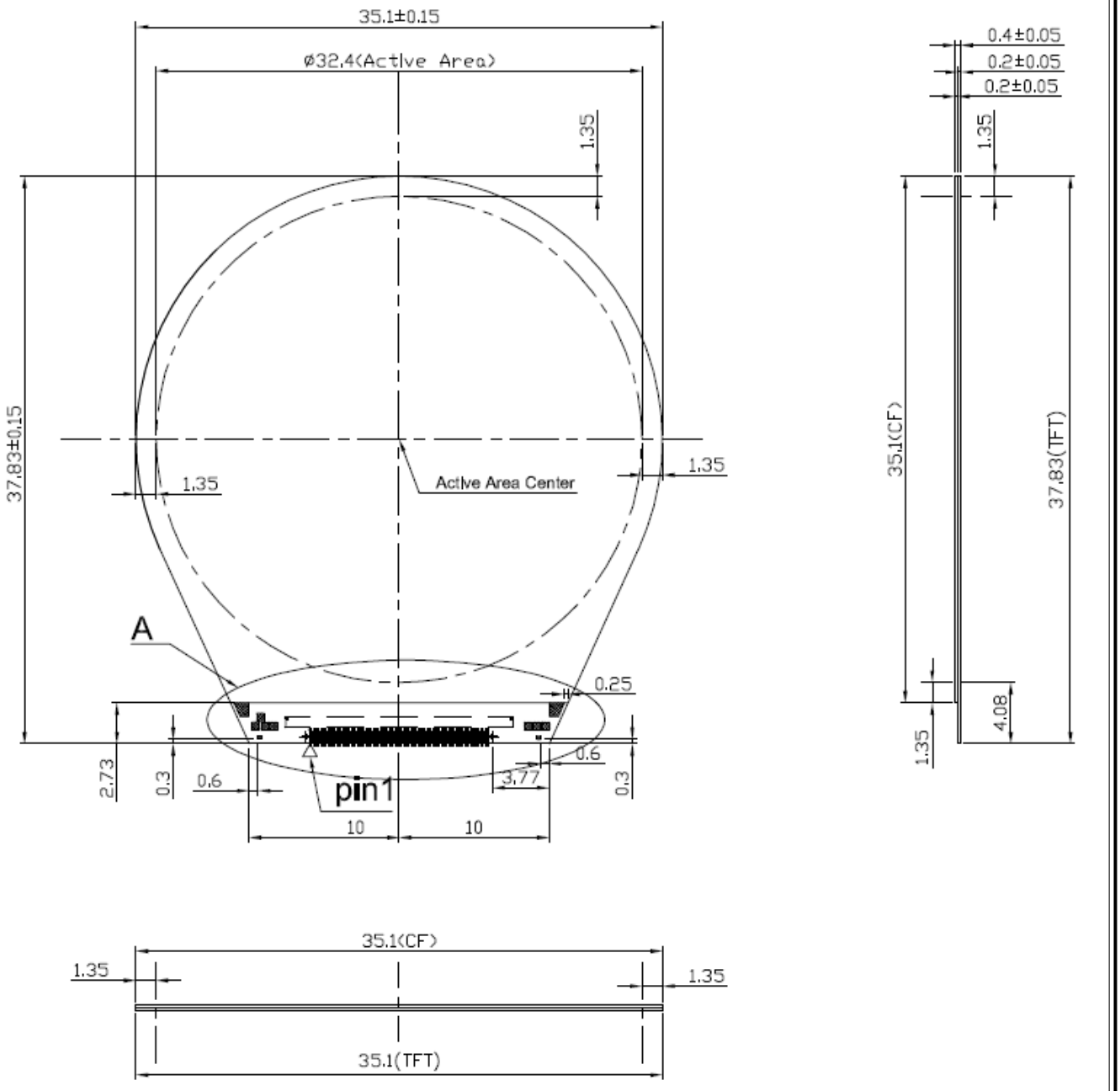
2nd Cutting Distance for 4 up-Sub C			
1	4.45	11	0.1
2	2.2	12	275.9
3	13.75	13	18.8
4	1.25	14	275.9
5	20	15	252.63
6	0.1	16	126.54
7	9.4	17	252.63
8	0.1	18	600
9	19	19	650
10	0.1		
unit：mm			

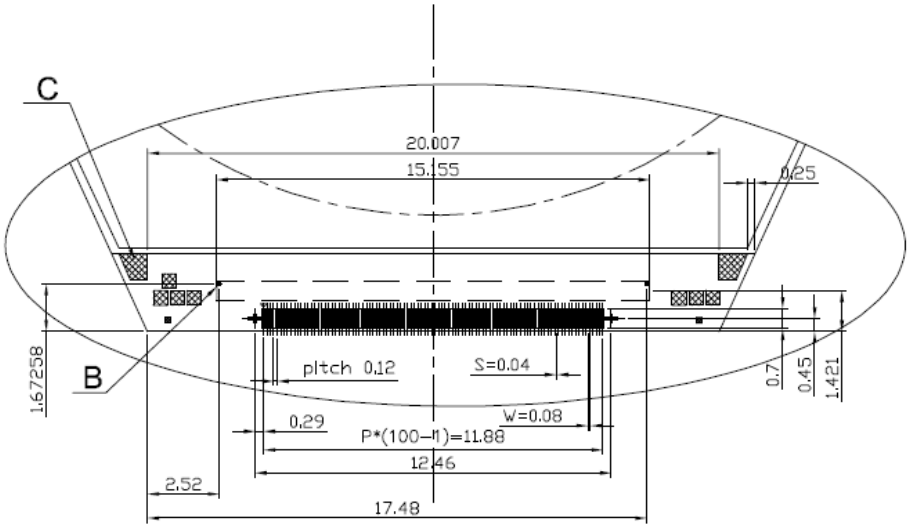
Sub D Array Film Up



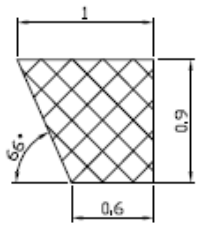
2nd Cutting Distance for 4 up-Sub D			
1	4.45	11	0.1
2	2.2	12	275.9
3	13.75	13	18.8
4	1.25	14	275.9
5	9.4	15	252.63
6	0.1	16	126.54
7	20	17	252.63
8	0.1	18	600
9	19	19	650
10	0.1		
unit：mm			

6.3 Chip Size

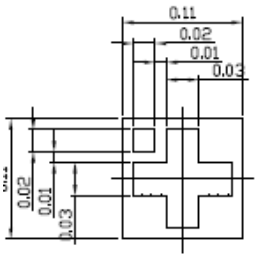




DETAIL A
SCALE 2:1



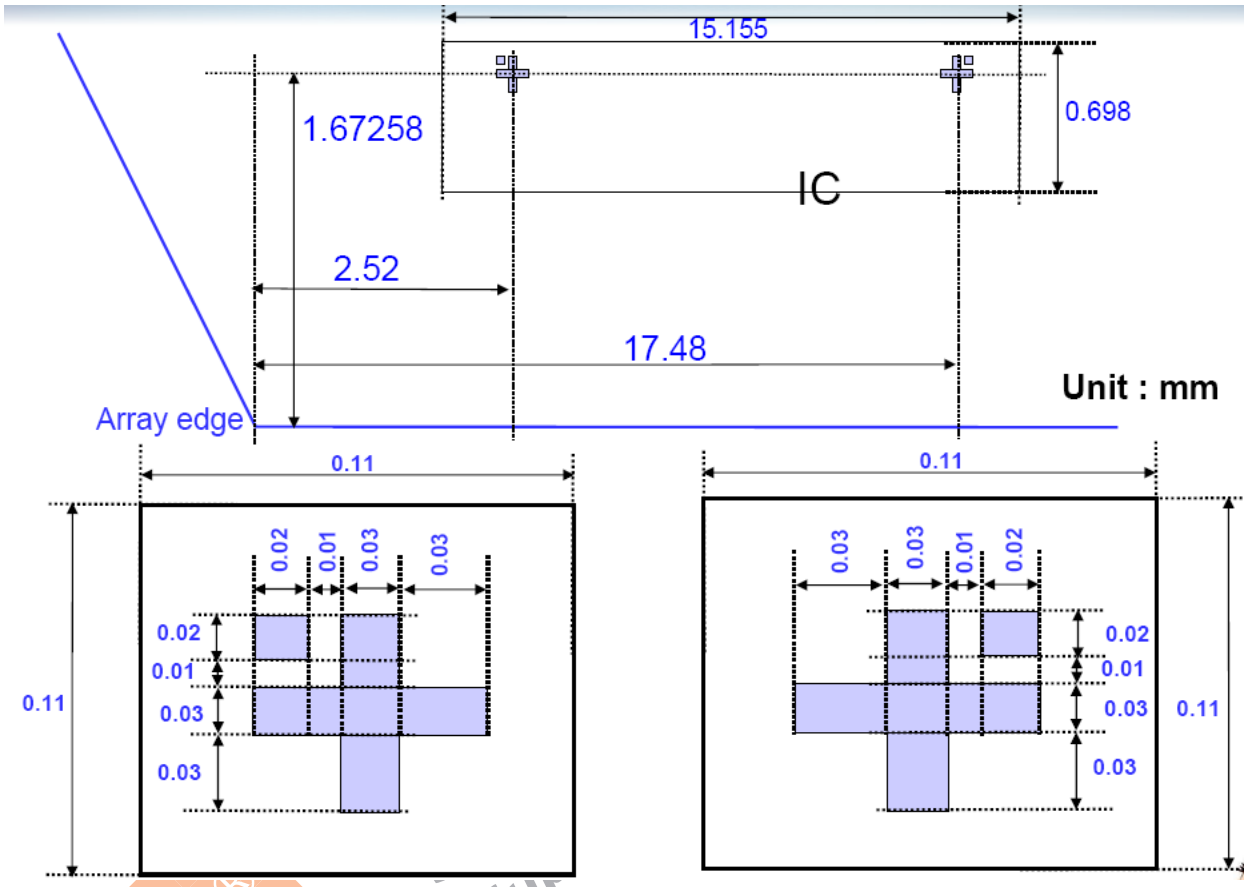
DETAIL C Ground Pad
SCALE 10:1



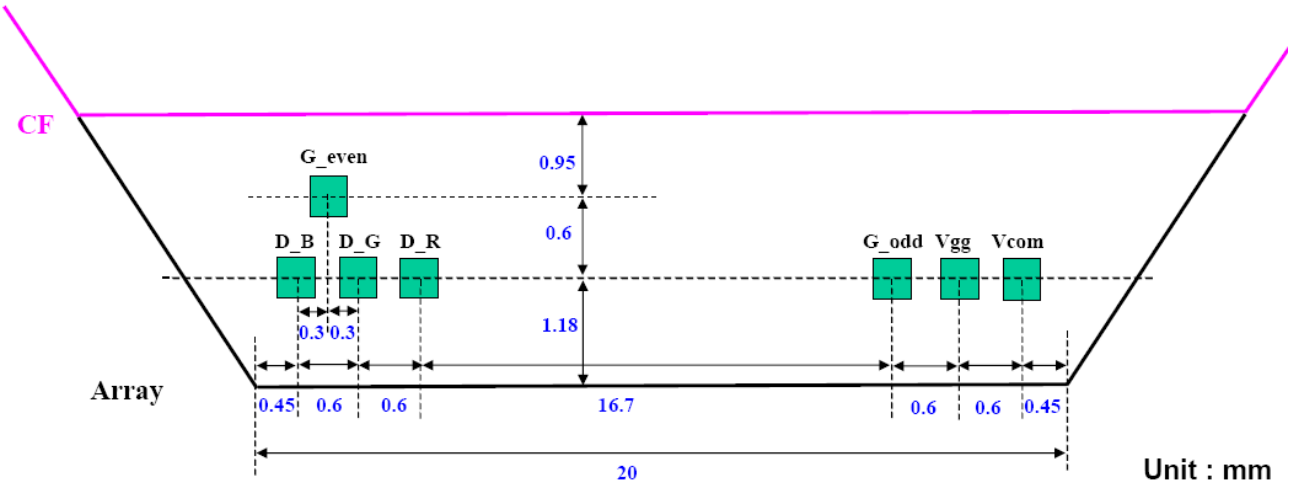
DETAIL B
SCALE 40:1

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

6.4 Driver IC Block Position

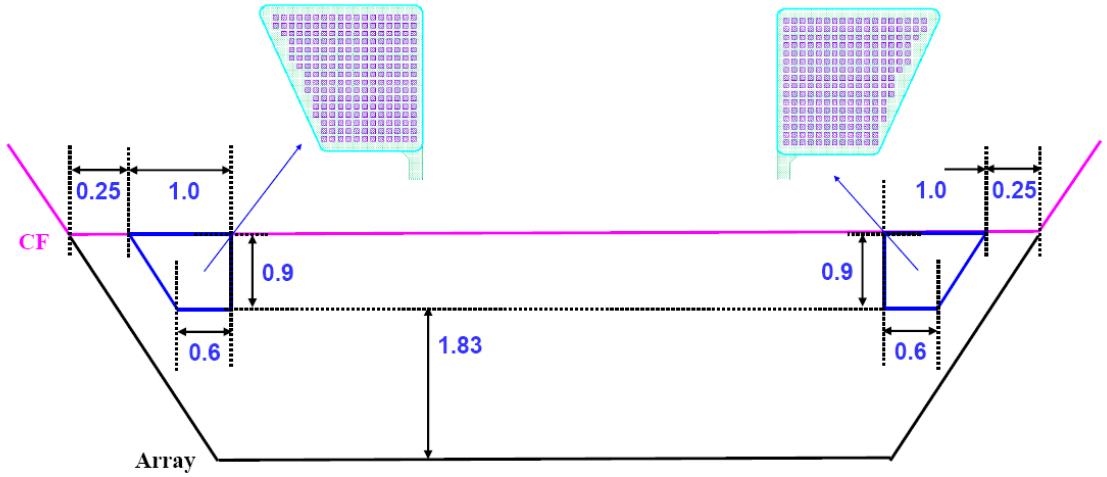


6.5 Test Pad Position



Pad size : 0.5 x 0.5

6.6 Ground Pad(銀膠點)



Unit : mm

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	1	5	B	4	N	5	-	A	*	*

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.

code 13,14: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	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
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

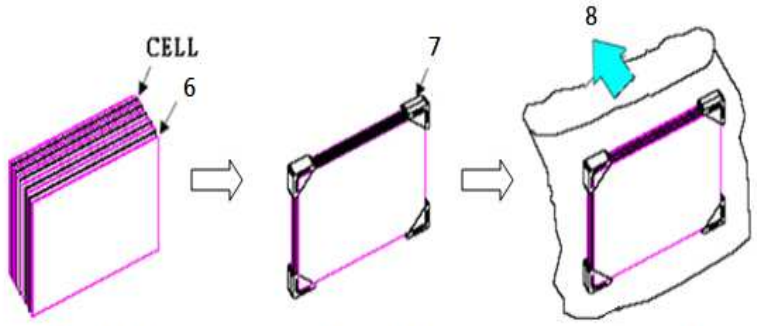
Code (6) : Date (1~9, A~X exp.I/O:10~31)
Code (7),(8),(9),(10) : Serial No.

(4) P/N: Hannstar internal part number

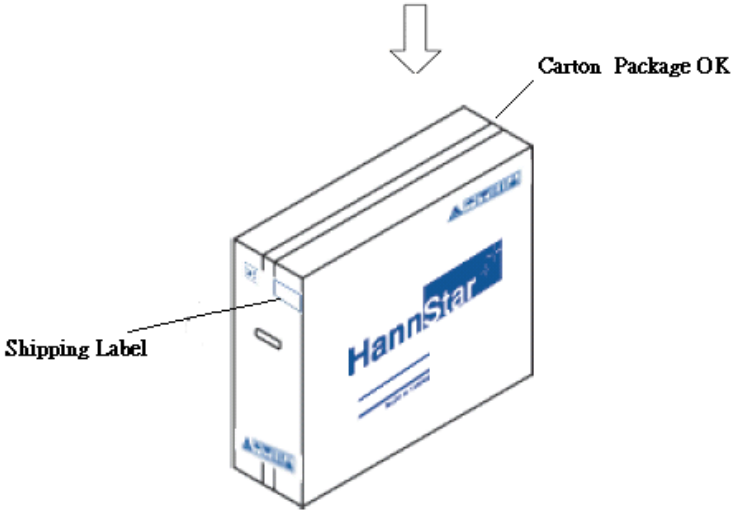
(5) QTY: Quantity of chip

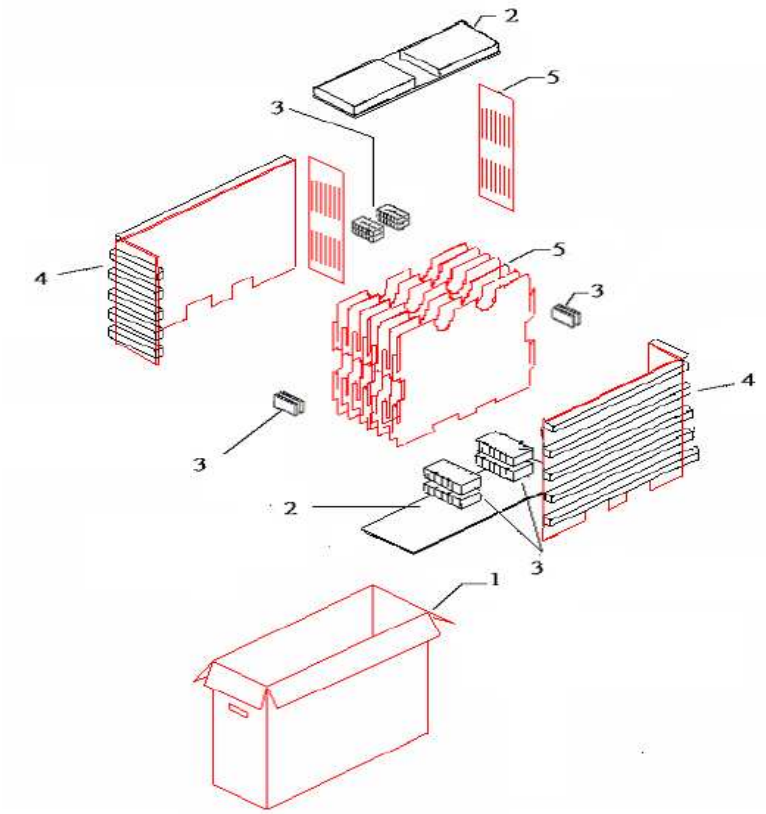
9.0 PACKAGE SPECIFICATION

9.1 Packing Form



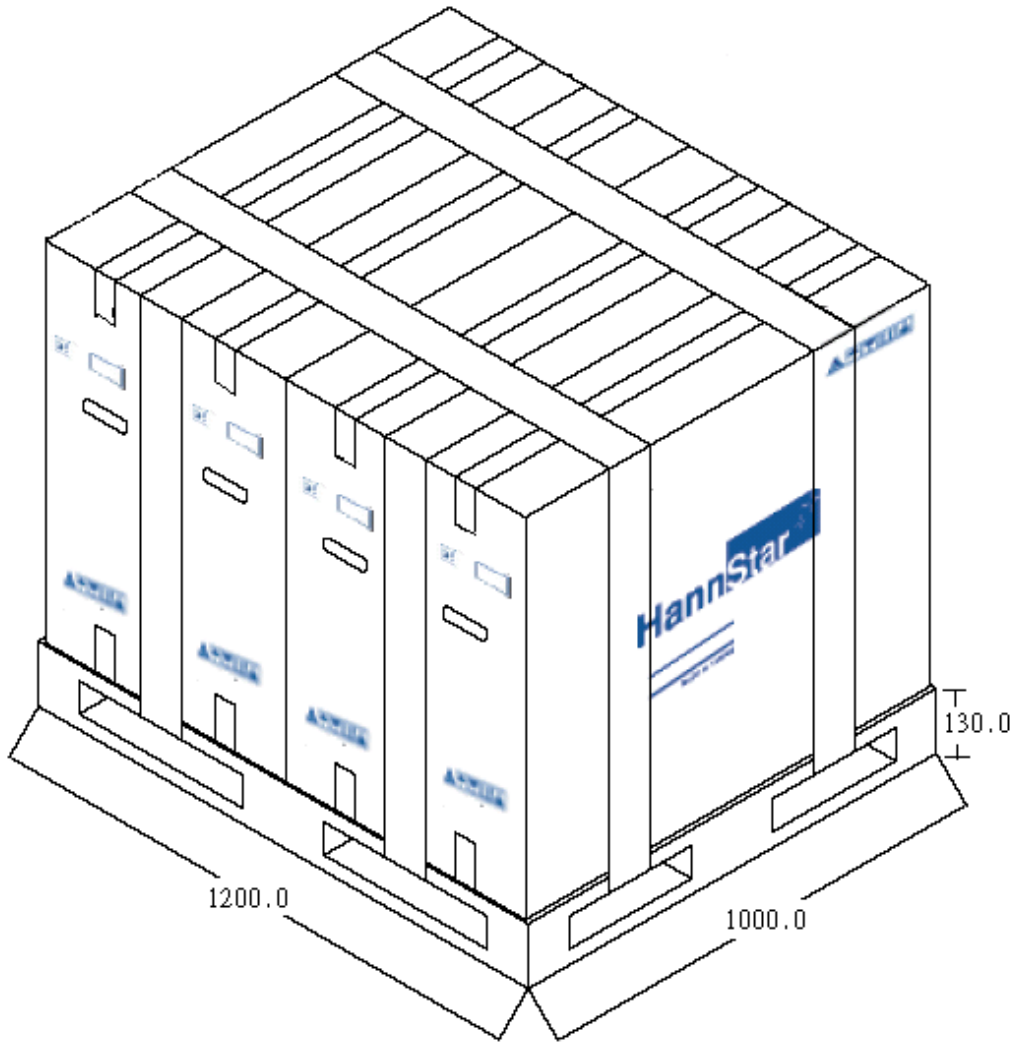
5 sheets x 8 packs = 40 sheets





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楞格組-A*2pcs B楞格組-B*7pcs
6	Paper	PCS	48	1 Bag*6pcs
7	Sheath	PCS	32	1 Bag*4pcs
8	Vacuum Bag	PCS	8	

9.2 Packing Assembly Drawings



Notes:
1 Pallet: 4 set Cartons
1 Pallet: 160 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 soft material.

10.5.4 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.

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.