TO :

Date :

HannStar Product Specification

(Formal)

2.8” Color TFT-LCD Module

Model：HSD028F3N3-A**

(Chip)

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.

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Record of Revisions

Rev.	Date	Sub-Model	Description of change
1.0	Aug.27,2015	A*	Formal Specification was first released.

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Contents

1.0 GENERAL DESCRIPTION 4

2.0 ABSOLUTE MAXIMUM RATINGS 5

3.0 ELECTRICALL SPECIFICATIONS 6

4.0 OPTICAL CHARACTERISTICS 13

5.0 PIXEL FORMAT 16

6.0 OUTLINE DIMENSION 17

7.0 RELIABILITY TEST ITEMS 23

8.0. LOT MARK 24

9.0 PACKAGE SPECIFICATION 26

10.0 GENERAL PRECAUTION 28

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1.0 GENERAL DESCRIPTION

1.1 Introduction

HannStar Display model HSD028F3N3-A* is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This TFT LCD has a 2.8 (4:3) inch diagonally measured active display area with QVGA (240 horizontal by 320 vertical pixel) resolution.

1.2 Features

- 2.8 (4:3 diagonal) inch configuration
- 262K color by 6 bit R.G.B signal input
- RoHS Compliance & Halogen Free

1.3 Applications

- Mobile Smart Phone
- Personal Navigation Device
- Multimedia applications and AV system

1.4 General Information

Item	Specification	Unit
Outline Dimension	46.2 (H) x 64.75 (V) x 0.8 (T) (Typ.)	mm
Display Area	43.2 (H) x 57.6 (V)	mm
Number of Pixel	240 RGB (H) x 320 (V)	pixels
Pixel Pitch	0.180 (H) x 0.180 (V)	mm
Pixel Arrangement	RGB Vertical Stripe	
Display Mode	Normally Black	

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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.

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3.0 ELECTRICALL SPECIFICATIONS

Item	Symbol	Min.	Typ.	Max.	Unit	Note
TFT Gate ON Voltage	VGH	12.5	13.5	14.5	V	*1
TFT Gate OFF Voltage	VGL	-9	-8	-7	V	*2
TFT Common Voltage	Vcom	-2		3	V	*3
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.

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3.1 FPC Pin Assignment

3.1.1 ILI9341V

No	Pin Define	No	Pin Define	No	Pin Define
1	GND	41	DB<16>	81	VSS
2	GND	42	DB<15>	82	VSS
3	VCOM	43	DB<14>	83	VSS
4	VCOM	44	DB<13>	84	VSS3
5	VCOM	45	DB<12>	85	VSS3
6	VCOM	46	DB<11>	86	VCI
7	VCOM	47	DB<10>	87	VCI
8	DUMMY	48	DB<9>	88	VCI
9	DUMMY	49	DB<8>	89	GND
10	GND	50	DB<7>	90	GND
11	GND	51	DB<6>	91	GND
12	GND	52	DB<5>	92	C11M
13	DUMMY	53	DB<4>	93	C11M
14	DUMMY	54	DB<3>	94	C11M
15	DUMMY	55	DB<2>	95	C11P
16	VCL	56	DB<1>	96	C11P
17	VCL	57	DB<0>	97	C11P
18	VCL	58	SDA	98	C12M
19	GVDD	59	DOTCLK	99	C12M
20	GVDD	60	ENABLE	100	C12M
21	VCORE	61	HSYNC	101	C12P
22	VCORE	62	VSYNC	102	C12P
23	VCORE	63	RDX	103	C12P
24	VCORE	64	WRX	104	AVDD
25	VCORE	65	DCX	105	AVDD
26	VDDI	66	CSX	106	AVDD
27	VDDI	67	RESX	107	VGL
28	VDDI	68	IM<0>	108	VGL
29	DB[23]_DUMMY	69	IM<1>	109	VGH
30	DB[22]_DUMMY	70	IM<2>	110	VGH
31	DB[21]_DUMMY	71	IM<3>	111	C21M
32	DB[20]_DUMMY	72	EXTC	112	C21P
33	DB[19]_DUMMY	73	VGS	113	C22M
34	DB[18]_DUMMY	74	DUMMY	114	C22P
35	VDDI_LED	75	VSSA	115	VCOM
36	LED_ON	76	VSSA	116	VCOM
37	LED_PWM	77	VSSA	117	VCOM
38	SDO	78	VSSC	118	VCOM
39	TE	79	VSSC	119	VCOM
40	DB<17>	80	VSSC	120	GND
				121	GND

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3.1.2 ILI9340F

No	Pin Define	No	Pin Define	No	Pin Define
1	GND	41	DB<16>	81	AGND
2	GND	42	DB<15>	82	AGND
3	VCOM	43	DB<14>	83	AGND
4	VCOM	44	DB<13>	84	AGND
5	VCOM	45	DB<12>	85	AGND
6	VCOM	46	DB<11>	86	VCI
7	VCOM	47	DB<10>	87	VCI
8	AGND	48	DB<9>	88	VCI
9	AGND	49	DB<8>	89	DDVDH
10	C41N	50	DB<7>	90	DDVDH
11	C41N	51	DB<6>	91	DDVDH
12	C41N	52	DB<5>	92	C11N
13	C41P	53	DB<4>	93	C11N
14	C41P	54	DB<3>	94	C11N
15	C41P	55	DB<2>	95	C11P
16	DDVDL	56	DB<1>	96	C11P
17	DDVDL	57	DB<0>	97	C11P
18	DDVDL	58	SDA	98	C12N
19	VREG1OUT	59	DOTCLK	99	C12N
20	VREG1OUT	60	ENABLE	100	C12N
21	VCORE	61	HSYNC	101	C12P
22	VCORE	62	VSYNC	102	C12P
23	VCORE	63	RDX	103	C12P
24	VCORE	64	WRX	104	DUMMY
25	VCORE	65	DCX	105	DUMMY
26	IOVCC	66	CSX	106	DUMMY
27	IOVCC	67	RESX	107	VGL
28	IOVCC	68	IM<0>	108	VGL
29	DUMMY	69	IM<1>	109	VGH
30	TEST_EN	70	IM<2>	110	VGH
31	TESTOSC	71	IM<3>	111	C21N
32	TEST0	72	EXTC	112	C21N
33	TEST1	73	VGS	113	C21P
34	TEST2	74	DUMMY	114	C21P
35	VDDI_LED	75	DGND	115	VCOM
36	LED_ON	76	DGND	116	VCOM
37	LED_PWM	77	DGND	117	VCOM
38	SDO	78	AGND	118	VCOM
39	TE	79	AGND	119	VCOM
40	DB<17>	80	AGND	120	GND
				121	GND

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3.1.3 HX8347I

No	Pin Define	No	Pin Define	No	Pin Define
1	GND	41	DB<16>	81	VSSC
2	GND	42	DB<15>	82	VSSC
3	VCOM	43	DB<14>	83	VSSC
4	VCOM	44	DB<13>	84	VSSC
5	VCOM	45	DB<12>	85	VSSC
6	VCOM	46	DB<11>	86	VCI
7	VCOM	47	DB<10>	87	VCI
8	DUMMY	48	DB<9>	88	VCI
9	DUMMY	49	DB<8>	89	VPP_OTP
10	DUMMY	50	DB<7>	90	VPP_OTP
11	DUMMY	51	DB<6>	91	VPP_OTP
12	DUMMY	52	DB<5>	92	C11N
13	DUMMY	53	DB<4>	93	C11N
14	DUMMY	54	DB<3>	94	C11N
15	DUMMY	55	DB<2>	95	C11P
16	VCL	56	DB<1>	96	C11P
17	VCL	57	DB<0>	97	C11P
18	VCL	58	SDA	98	C12N
19	VREG1OUT	59	DOTCLK	99	C12N
20	VREG1OUT	60	DE	100	C12N
21	VDDD	61	HSYNC	101	C12P
22	VDDD	62	VSYNC	102	C12P
23	VDDD	63	NRD	103	C12P
24	VDDD	64	NWR_SCL	104	DDVDH
25	VDDD	65	DNC_SCL	105	DDVDH
26	IOVCC	66	NCS	106	DDVDH
27	IOVCC	67	NRESET	107	VGL
28	IOVCC	68	IM<0>	108	VGL
29	DUMMY	69	IM<1>	109	VGH
30	DUMMY	70	IM<2>	110	VGH
31	DUMMY	71	IM<3>	111	C21N
32	DUMMY	72	IFSEL	112	C21P
33	DUMMY	73	DUMMY	113	C22N
34	DUMMY	74	TEST1	114	C22P
35	DUMMY	75	VSSD	115	VCOM
36	BC_CTRL	76	VSSD	116	VCOM
37	CABC_PWM_OUT	77	VSSD	117	VCOM
38	TEST3_SDO	78	VSSA	118	VCOM
39	TE	79	VSSA	119	VCOM
40	DB<17>	80	VSSA	120	GND
				121	GND

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3.1.4 ST7789V

No	Pin Define	No	Pin Define	No	Pin Define
1	GND	41	DB<16>	81	AGND
2	GND	42	DB<15>	82	AGND
3	VCOM	43	DB<14>	83	AGND
4	VCOM	44	DB<13>	84	AGND
5	VCOM	45	DB<12>	85	AGND
6	VCOM	46	DB<11>	86	VDD
7	VCOM	47	DB<10>	87	VDD
8	DUMMYR2	48	DB<9>	88	VDD
9	DUMMYR1	49	DB<8>	89	DUMMY
10	AGND	50	DB<7>	90	DUMMY
11	AGND	51	DB<6>	91	DUMMY
12	AGND	52	DB<5>	92	V20
13	DUMMY	53	DB<4>	93	V20
14	DUMMY	54	DB<3>	94	V20
15	DUMMY	55	DB<2>	95	VAP
16	VGH	56	DB<1>	96	DUMMY
17	VGH	57	DB<0>	97	DUMMY
18	VGH	58	SDA	98	DUMMY
19	VPP	59	DOTCLK	99	DUMMY
20	VPP	60	ENABLE	100	VAN
21	VCC	61	HSYNC	101	AVCL
22	VCC	62	VSYNC	102	AVCL
23	VCC	63	RDX	103	AVCL
24	VCC	64	WRX	104	AVDD
25	VCC	65	DCX	105	AVDD
26	VDDI	66	CSX	106	AVDD
27	VDDI	67	RESX	107	VGL
28	VDDI	68	IM<0>	108	VGL
29	TESTO5	69	IM<1>	109	DUMMY
30	TESTO4	70	IM<2>	110	DUMMY
31	TESTO3	71	IM<3>	111	DUMMY
32	TESTO2	72	EXTC	112	VDDGX
33	TESTO1	73	DUMMY	113	VDDS
34	TE2	74	TEST3	114	VAG
35	VDDI_LED	75	DGND	115	VCOM
36	LED_EN	76	DGND	116	VCOM
37	LED_PWM	77	DGND	117	VCOM
38	SDO	78	AGND	118	VCOM
39	TE	79	AGND	119	VCOM
40	DB<17>	80	AGND	120	GND
				121	GND

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3.2 TFT Design Rules

Item		Specification	unit
COG ILITEK ILI9341V or compatible	Chip size	15870 x 650	μm
	Pad number	1278	~
	Pin assignment	Based on the ILI9341V Spec.	
COG ILITEK ILI9340F or compatible	Chip size	15550 x 700	μm
	Pad number	1278	~
	Pin assignment	Based on the ILI9341 Spec.	
COG HIMAX HX8347I or compatible	Chip size	15162 x 660	μm
	Pad number	1278	~
	Pin assignment	Based on the HX8347I Spec.	
COG Sitronix ST7789V or compatible	Chip size	15155 x 698	μm
	Pad number	1278	~
	Pin assignment	Based on the ST7789V Spec.	

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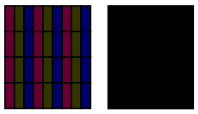
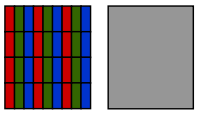
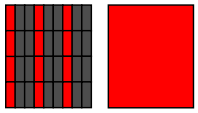
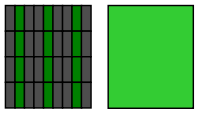
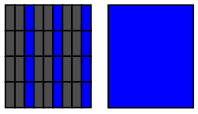
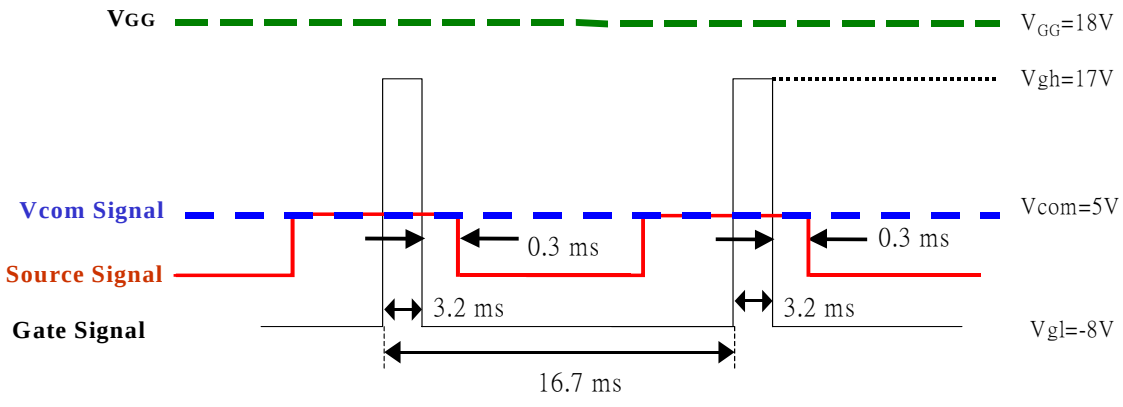
3.3 Cell Test Light On Waveform

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-2



Vdata= 0V and 5V

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4.0 OPTICAL CHARACTERISTICS

4.1 Optical Specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T (%)	Θ=0 Normal viewing angle	—	3.9	—	%	Measuring with Polarizer，Reference Only
Transmittance (without Polarizer)		T (%)		—	14.5	—	%	
Contrast Ratio		CR		600	800	—	—	(1)(2)
Response Time		T_R+T_F		—	30	40	msec	(1)(3)
Color Gamut	(%)			—	70	—	%	C-light
Color Chromaticity (CIE1931)	White	W_x		0.286	0.306	0.326	—	(1)(4) CF glass
		W_y		0.307	0.327	0.347		
	Red	R_x		0.634	0.654	0.674	—	
		R_Y		0.296	0.316	0.336		
	Green	G_x		0.244	0.264	0.284	—	
		G_Y		0.553	0.573	0.593		
	Blue	B_x		0.121	0.141	0.161	—	
		B_Y		0.066	0.086	0.106		
Viewing Angle	Hor.	$Θ_L$	CR>10	—	80	—	—	(1)(4) Measuring with Polarizer，Reference Only
		$Θ_R$		—	80	—		
	Ver.	$Θ_U$		—	80	—		
		$Θ_D$		—	80	—		
Optima View Direction		Free						(5)

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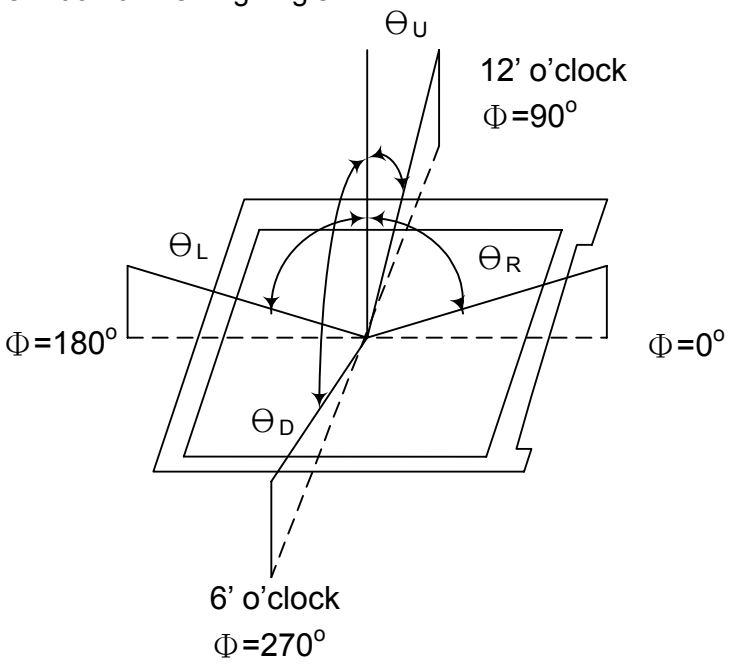
4.2 Measuring Condition

- 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

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

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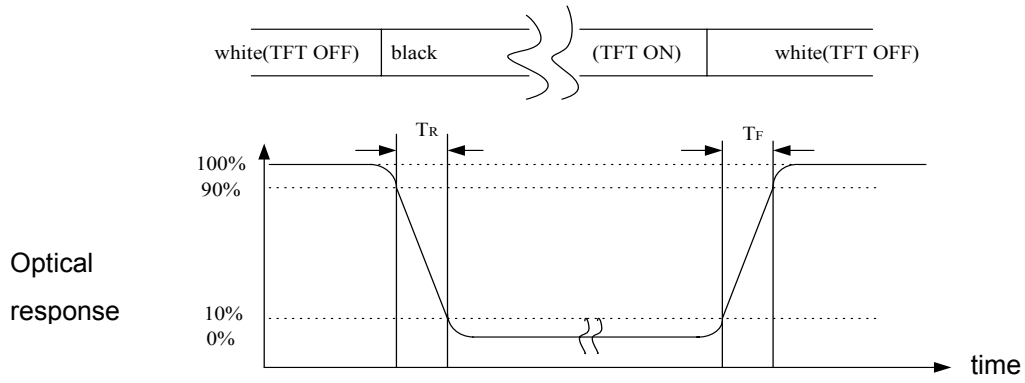
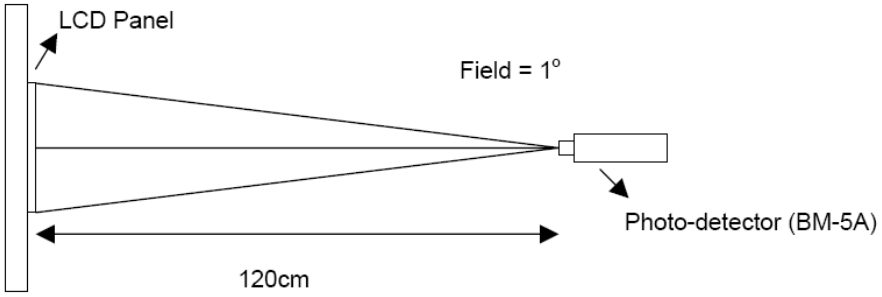
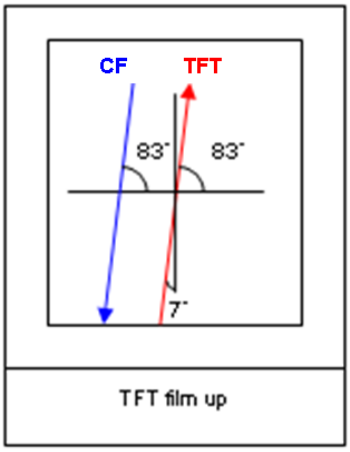
Note (3) Definition of Response Time: Sum of T_R and T_F



Note (4) Definition of optical measurement setup



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



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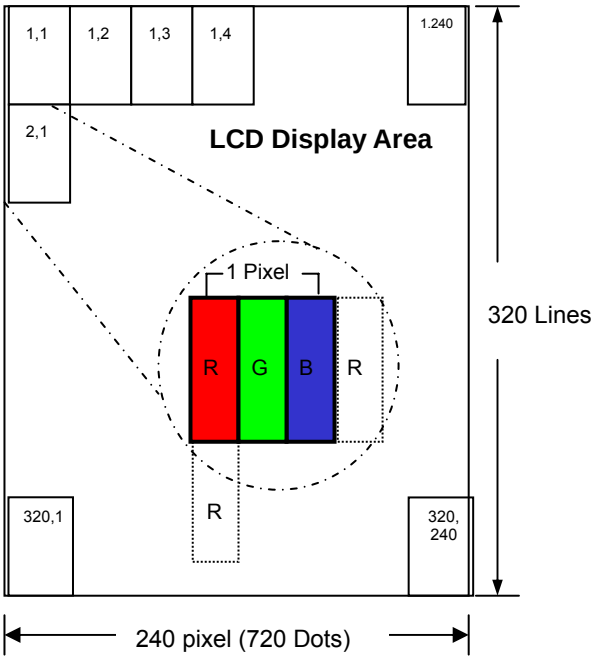
5.0 PIXEL FORMAT



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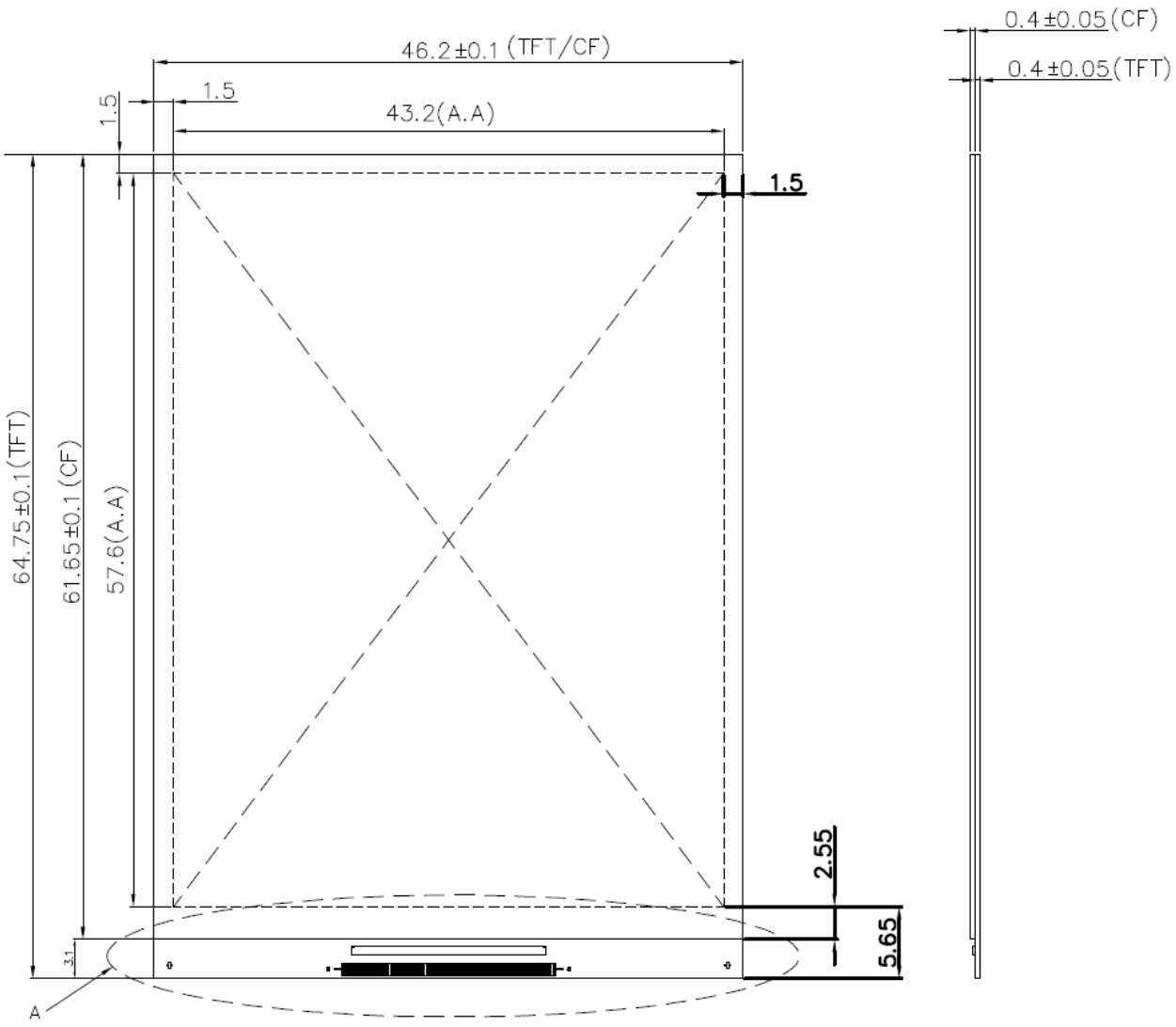
6.0 OUTLINE DIMENSION

6.1 Chip Size



Side view (1:1)

Front view (1:1)

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

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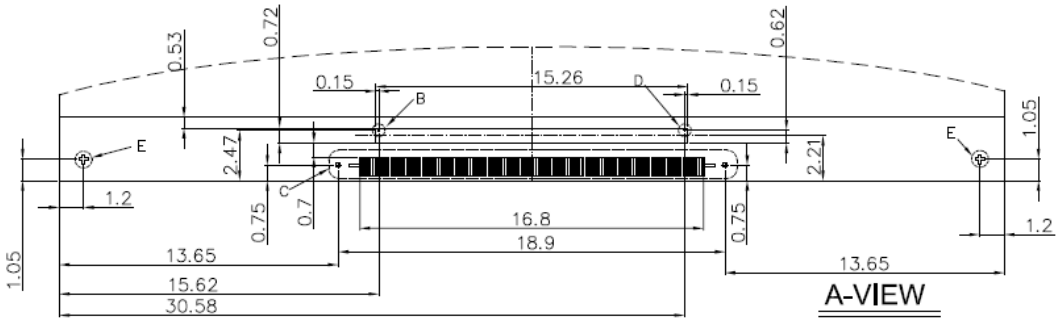
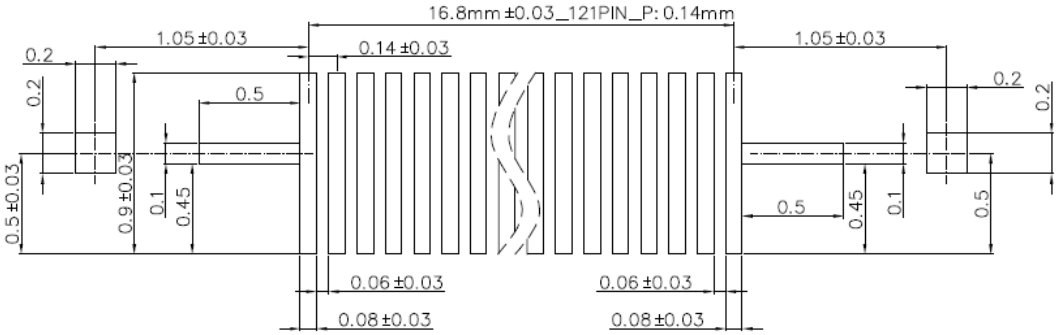
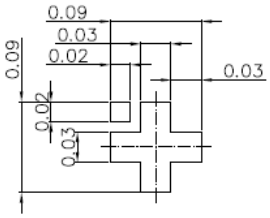


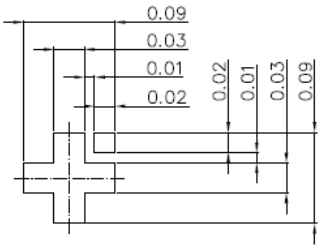
A-VIEW



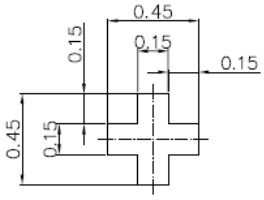
C-VIEW



B-VIEW 100X



D-VIEW 100X



E-VIEW 20X

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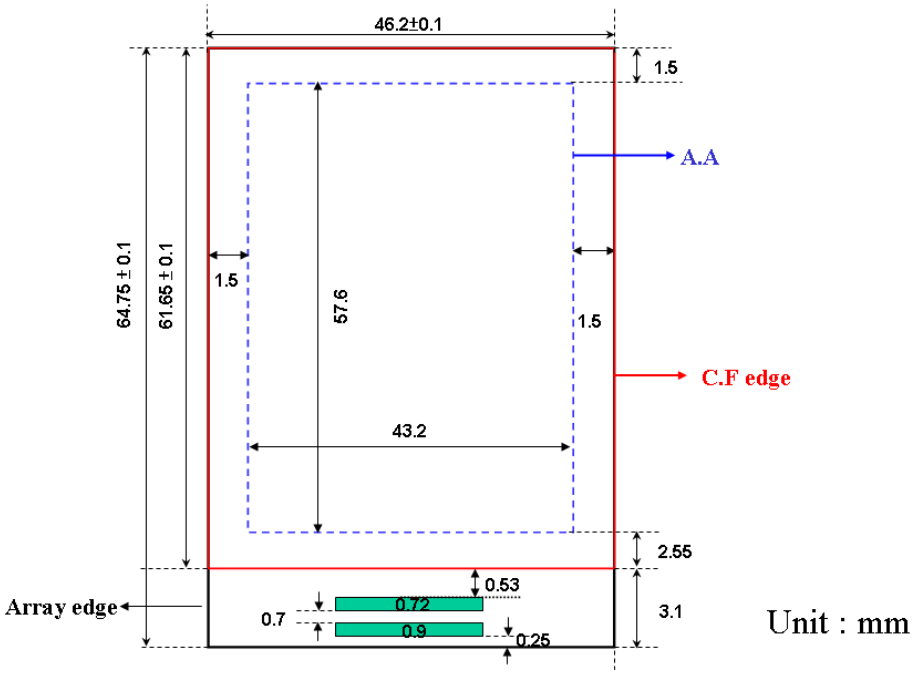
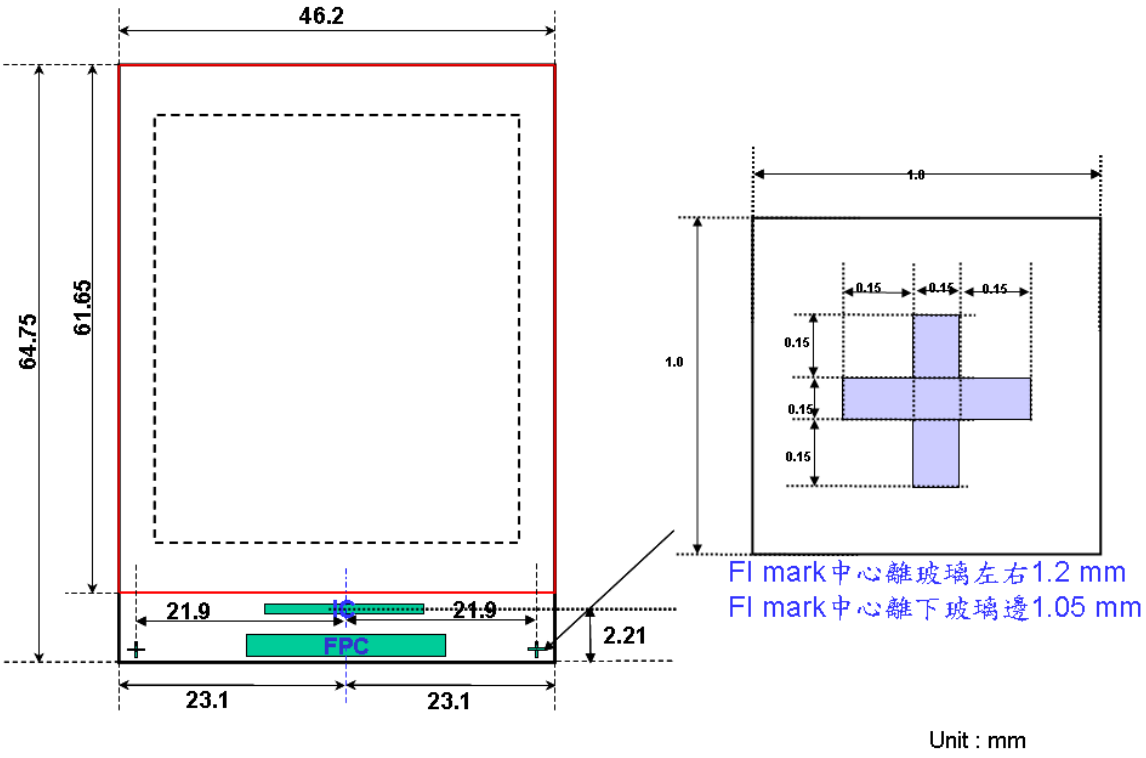
6.2 IC & FPC Position





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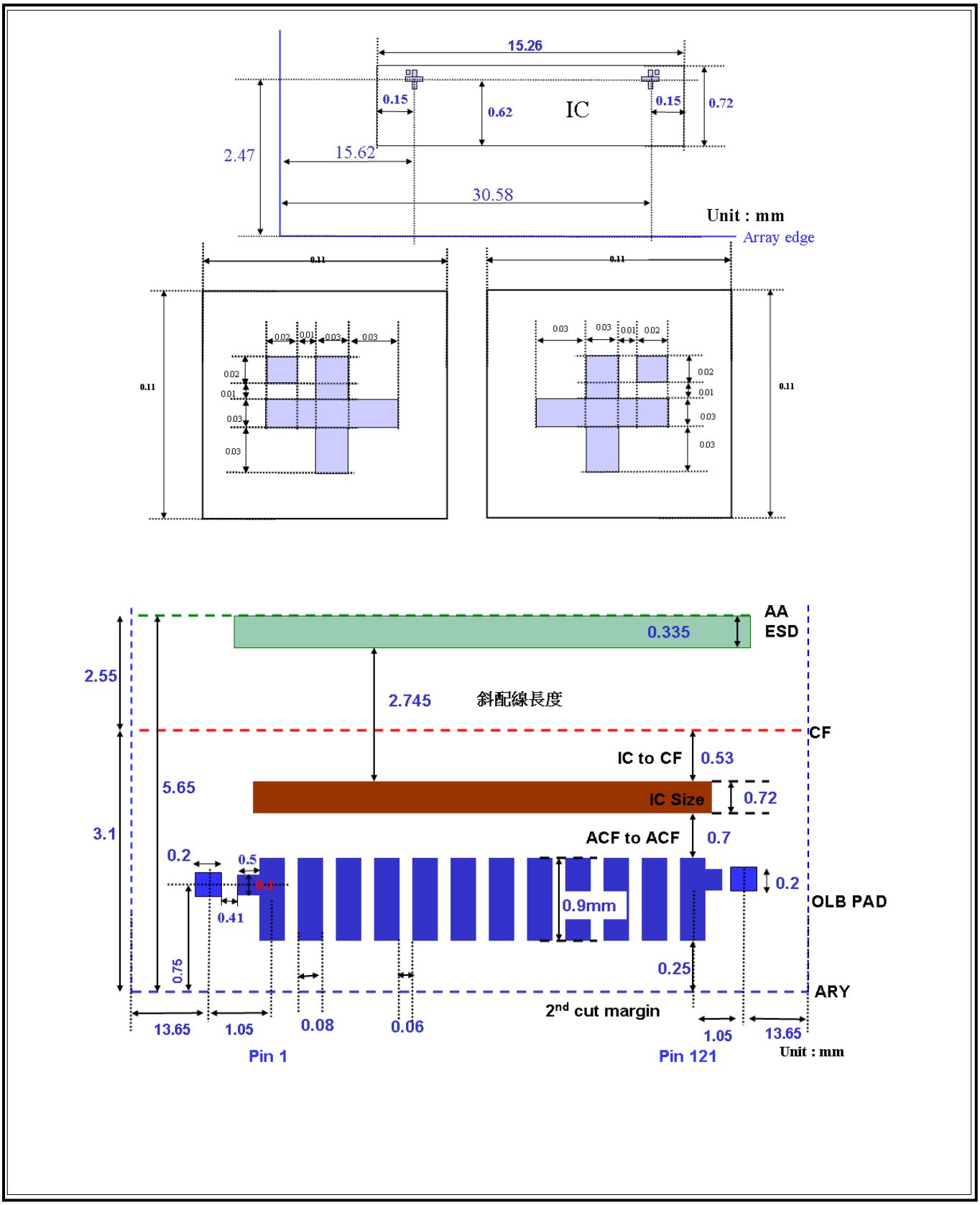

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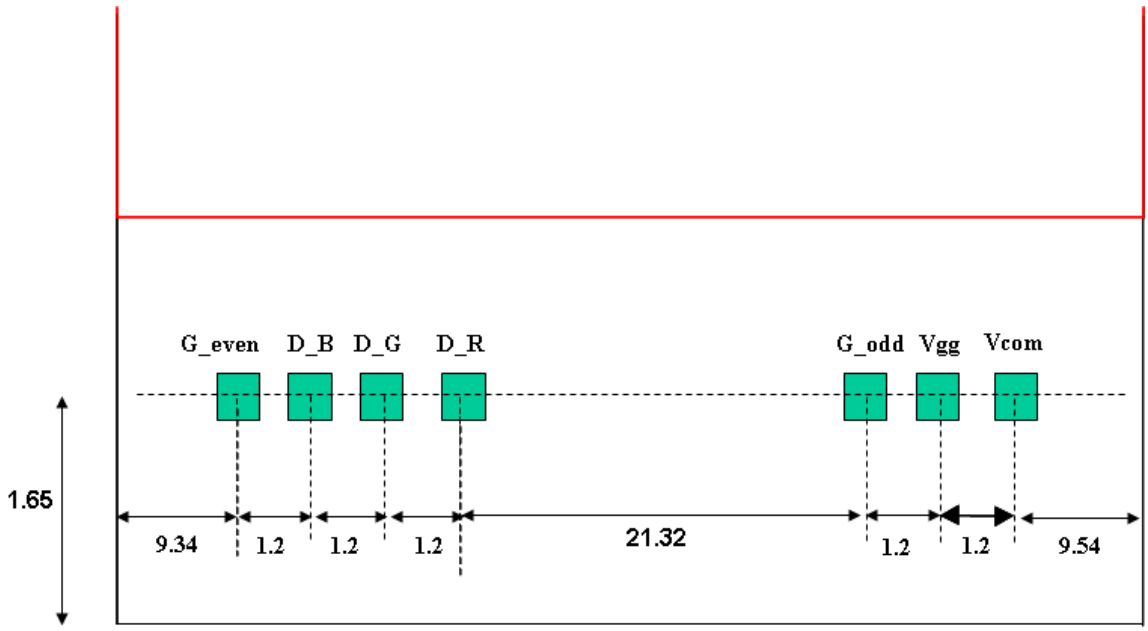
6.3 Cell Test



Pad size : 1.0 x 1.0

Unit : mm

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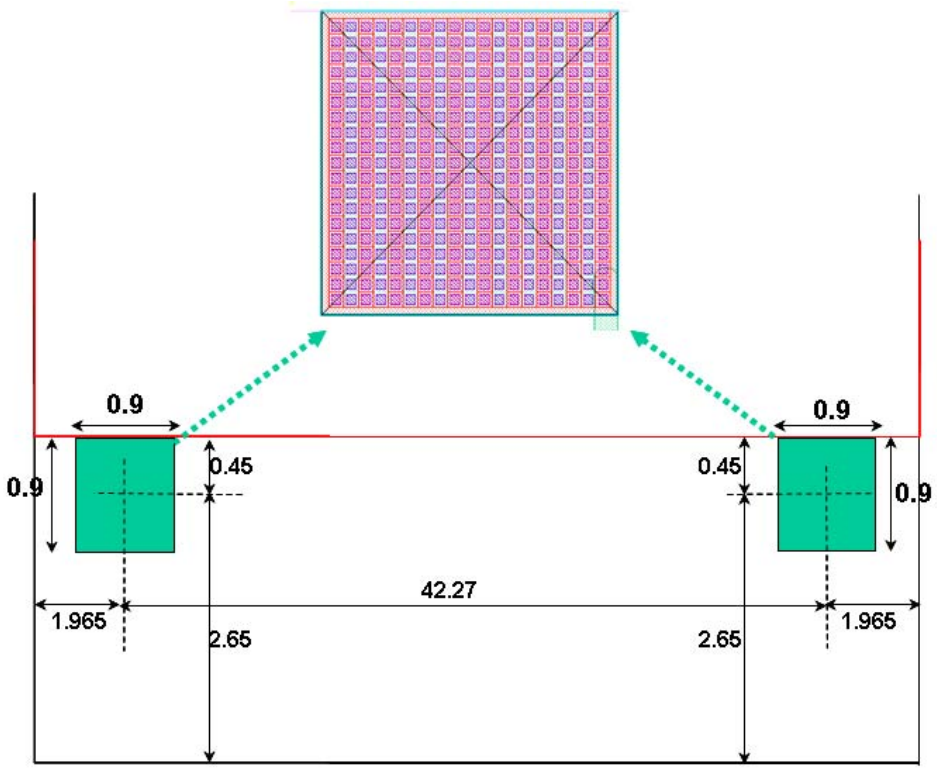
6.4 Ground PAD 銀膠點



Pad size : 0.9x0.9

Unit:mm

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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.

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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	4	0	C	8	W	1	-	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

G= Full cell with Polarizer+IC

code 8 : Resolution

1=QQVGA ; 2=QCIF+ ; 3=QVGA ; 4=QQVGA- ;5=960x234 ; 6=480x234/480x240 ; 8=480X854/480X800 ; 9=480x272 ; A=240x400/240x432 ; C=640x234; D=800x480 ; E=SXGA ; F=1024x576/1024x600 ; G=WXGA+; H=HDTV ;J=720x480; K=WSXGA+ ;M=qHD ; 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.

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(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

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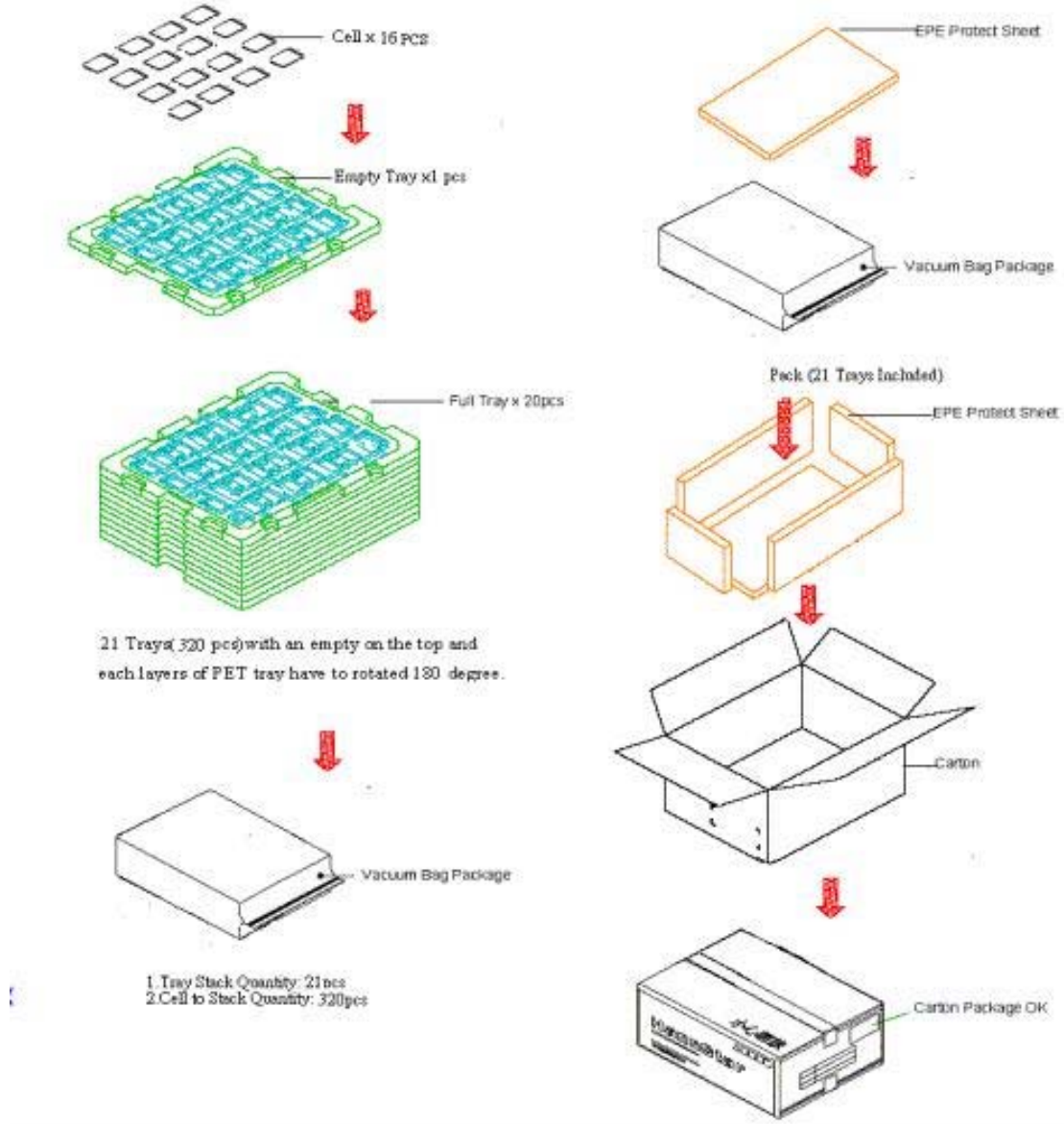
9.0 PACKAGE SPECIFICATION

9.1 Packing Form



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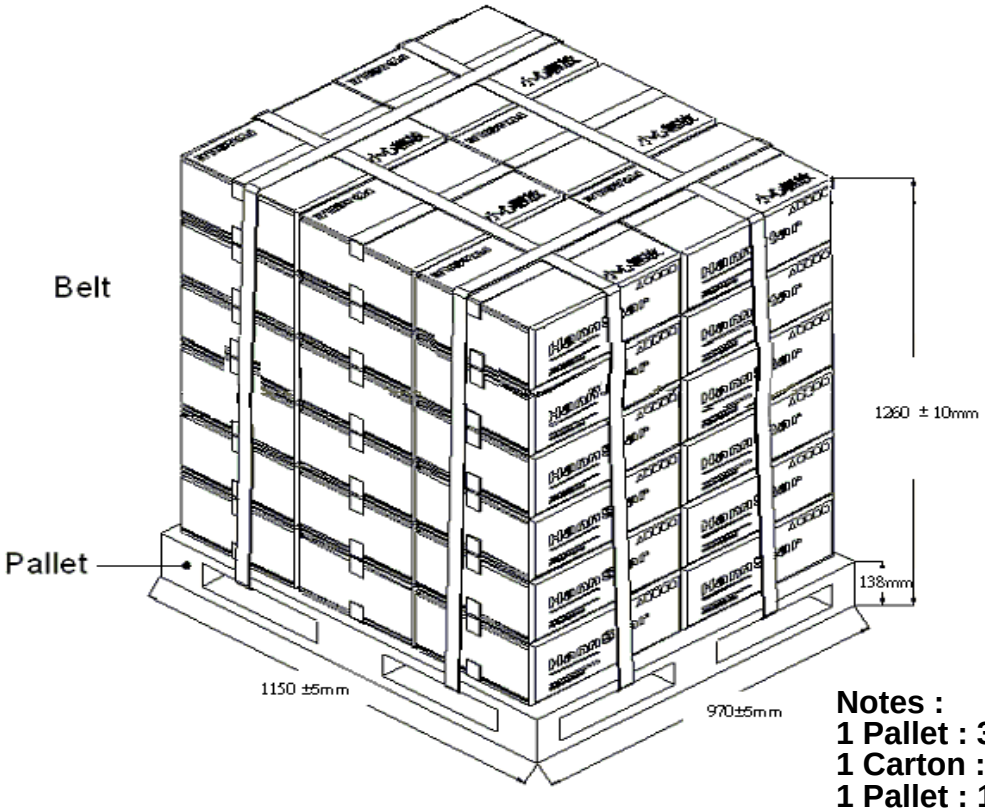
9.2 Packing Assembly Drawings



Notes :
1 Pallet : 36 Cartons
1 Carton : 240pcs. Cells
1 Pallet : 11520pcs. Cells

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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 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.

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.

10.3.3. 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 Electric Shock

10.4.1. Disconnect power supply before handling LCD module.

10.4.2. Do not pull or fold the LED cable.

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

10.5 Absolute Maximum Ratings and Power Protection Circuit

10.5.1. 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.

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

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

10.6 Operation

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

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

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

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10.6.4 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.

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

10.7 Mechanism

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

10.8 Static Electricity

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

10.8.2 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.

10.9 Strong Light Exposure

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

10.10 Disposal

When disposing LCD module, obey the local environmental regulations.

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4.0 OPTICAL CHARACTERISTICS → min 值僅供客戶有特殊需求時標示。

4.1 Optical Specification

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)	T (%)	Θ=0 Normal viewing angle	3.4	3.9	—	%	Measuring with Polarizer， Reference Only
Transmittance (without Polarizer)	T (%)		12.6	14.5	—	%	

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