IVO **InfoVision Optoelectronics (Kunshan) Co.,LTD.**

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Customer Approval Specification

To:

Product Name: C024SN21-0

Document Issue Date: 2018/06/16

<table>
<tr><td>SIGNATURE

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Please return 1 copy for your confirmation with your signature and comments.</td><td>InfoVision Optoelectronics

SIGNATURE

REVIEWED BY

QA

_____

PREPARED BY
FAE

_____</td></tr>
</table>

Note: 1. Please contact InfoVision Company. before designing your product based on this product.
    2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by IVO for any intellectual property claims or other problems that may result from application based on the module described herein.

FQ-7-30-0-009-03D

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Revision	Date	Page	Old Description	New Description	Remark
00	2018/06/16	All	-	First issued.	-

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Contents

1 General Description

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1.1 Introduction

The C024SN21-0 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) Single Chip and Sub Chips that uses amorphous silicon TFT as a switching device. This TFT LCD panel has a 2.4 inch diagonally measured active display area with QVGA resolution (240 horizontal by 320 vertical pixels array).

1.2 Features

■ 2.4" TFT-LCD Panel
■ Supported QVGA Resolution
■ Compatible with ROHS Standard

2 General Characteristics

Table 1   General Characteristics

Item	Specification	Unit	Note
Screen Diagonal	2.4	Inch	-
Active Area (H x V)	36.72 *48.96	mm	Single Chip
Number of Dots (H x V)	240(RGB) * 320	-	Single Chip
Pixel Pitch (H x V)	0.153 *0.153	mm	Single Chip
Cell Outline Dimension (H x V x D)	40.32*56.26*1.0	mm	Single Chip
Display Type	Transmissive	-	-
Display Mode	Normally White	-	-
View Direction	12 o'clock	-	-
Response Time	30(Typ.)	ms	-
Contrast Ratio	500 (Typ.)	-	-
Viewing Angle (Up/Down/ Left/Right)	45/20/45/45	deg.	-
NTSC	55 (Typ.)	%	-
Panel Transmittance	5.4(Typ.)	%	Under C-light-Full cell
	15.0(Typ.)	%	Under C-light-Bare cell
Color Filter Structure	Strip RGB	-	-
Weight	5.35(Typ.)	g	Single Chip
	590.26(Typ.)	g	100 chips
	531.76(Typ.)	g	90 chips

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3　Absolute Maximum Ratings

Table 2 Absolute Ratings of Environment

Item	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	TOP	-20	70	℃	
Operating Humidity	HOP	10	80	%RH	(1),(2)
Storage Temperature	TST	-30	80	℃	
Storage Humidity	HST	10	90	%RH	

Note　(1) Maximum Wet-Bulb should be 39 ℃. No condensation.

　　　(2) When you apply the LCD panel for OA system. Please make sure to keep the temperature of LCD panel is less than 80℃.

4　Pixel Format

The figure shows the relationship of the input signals and LCD panel pixel format.

Figure 1 Pixel Format

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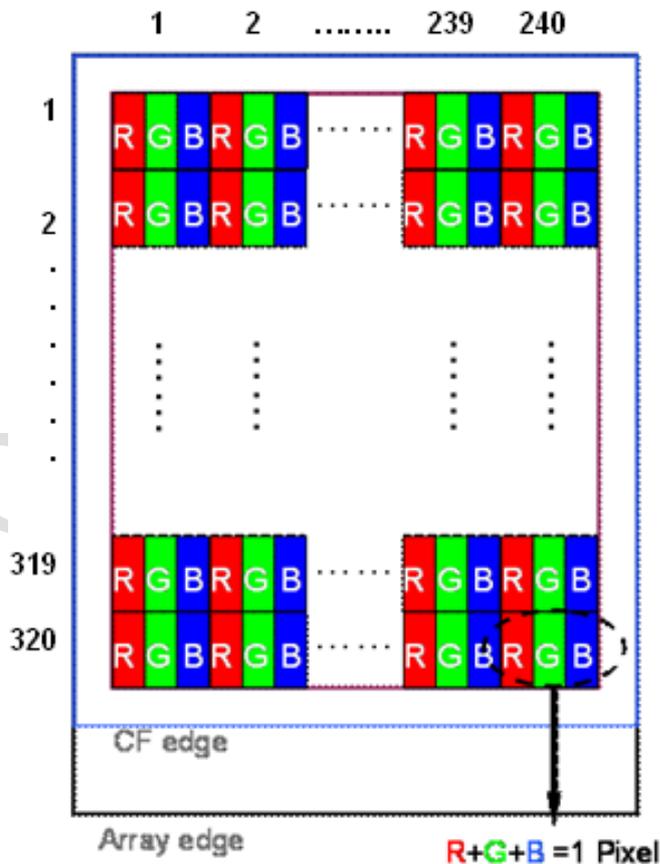
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5 Optical Characteristics

The optical characteristics are measured under stable conditions as following notes.

Table 3   Optical Characteristics

Item	Conditions		Min.	Typ.	Max.	Unit	Note
Viewing Angle （CR>10）	Horizontal	θ_{x+}	-	45	-	deg.	(1),(2),(6),(7),(8)
		θ_{x-}	-	45	-		
	Vertical	θ_{y+}	-	45	-		
		θ_{y-}	-	20	-		
Contrast Ratio	Center		-	500	-	-	(1),(3),(6)(7),(8)
Response Time	Rising + Falling		-	30	-	ms	(1),(4),(6),(7),(8)
CF Color Chromaticity (CIE1931)	Red x		Typ. -0.03	0.626	Typ. +0.03	-	Under C-light
	Red y			0.336		-	
	Green x			0.276		-	
	Green y			0.550		-	
	Blue x			0.144		-	
	Blue y			0.130		-	
	White x			0.307		-	
	White y			0.329		-	
NTSC	CIE1931		-	55	-	%	(1),(6),(7),(8)
Transmittance	-		4.97	5.4	-	%	(1),(5),(6),(7),(8)
			13.8	15.0	-	%	

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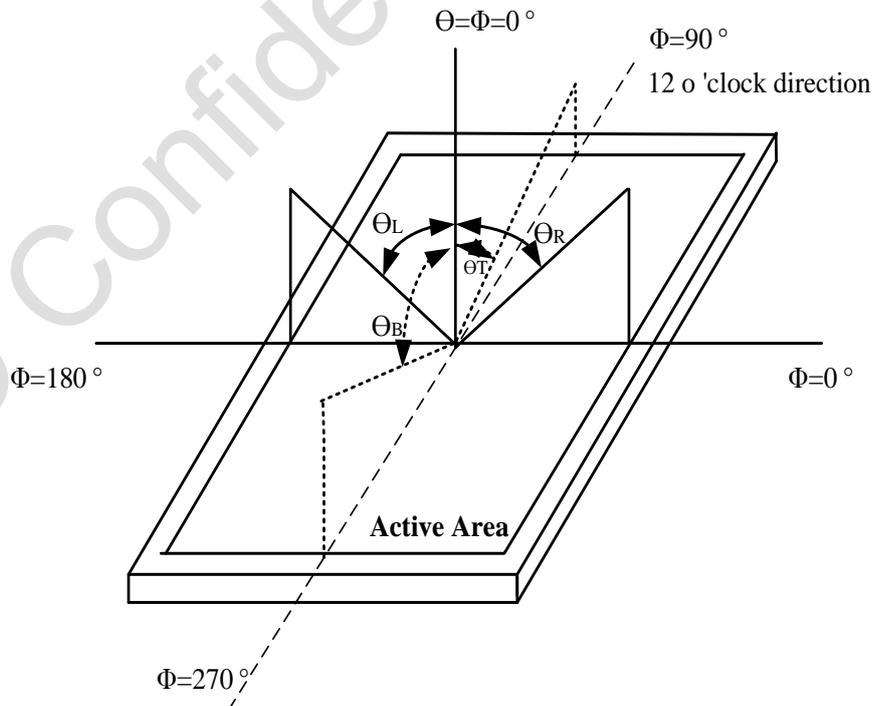| Document name	C024SN21-0 Customer Approval Specification		Page 7 of 27	
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Note (1) Measurement Setup:

The LCD module should be stabilized at given temperature(25℃) for 15 minutes to Avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 15 minutes in a windless room.

Figure 2 Measurement Setup
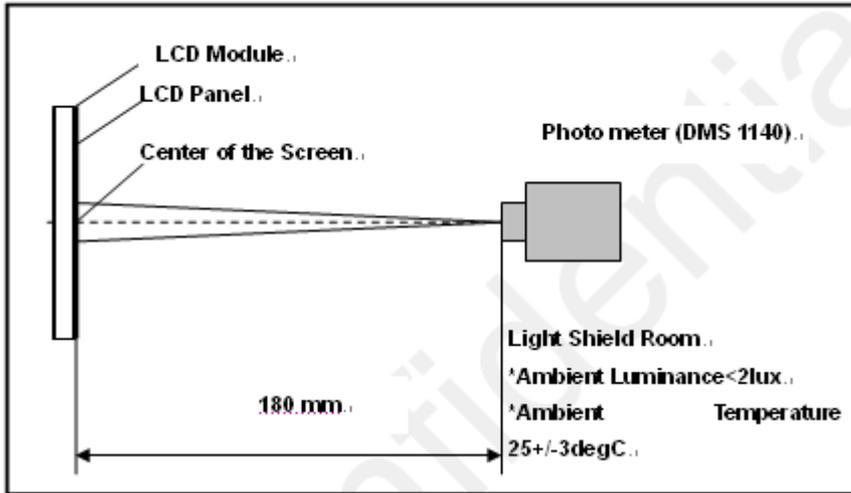
Note (2) Definition of Viewing Angle

Figure 3 Definition of Viewing Angle

Note (3) Definition Of Contrast Ratio (CR)

The contrast ratio can be calculated by the following expression

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Contrast Ratio (CR) = L63 / L0

L63: Luminance of gray level 63, L0: Luminance of gray level 0

Note (4) Definition Of Response Time (TR, TF)
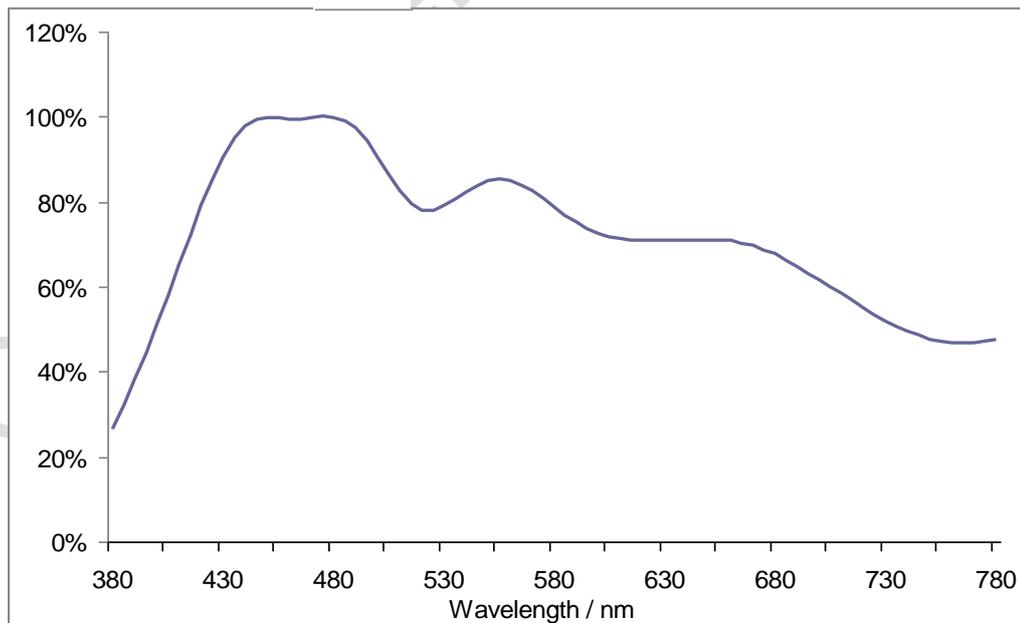
Figure 4 Definition of Response Time
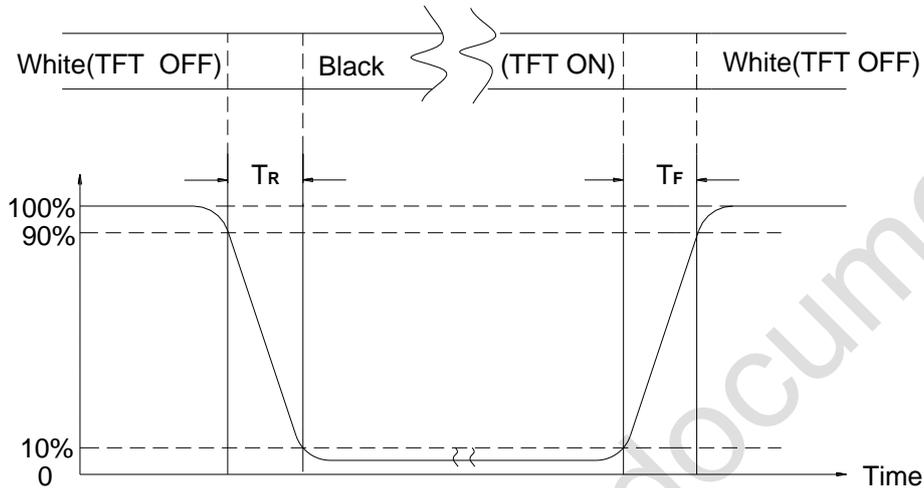
Note (5) Definition of Transmittance (Module is without signal input and IVO reference backlight).

$$\text{Transmittance} = \frac{\text{Luminance of LCD Module}}{\text{Luminance of Back light}} \times 100\%$$

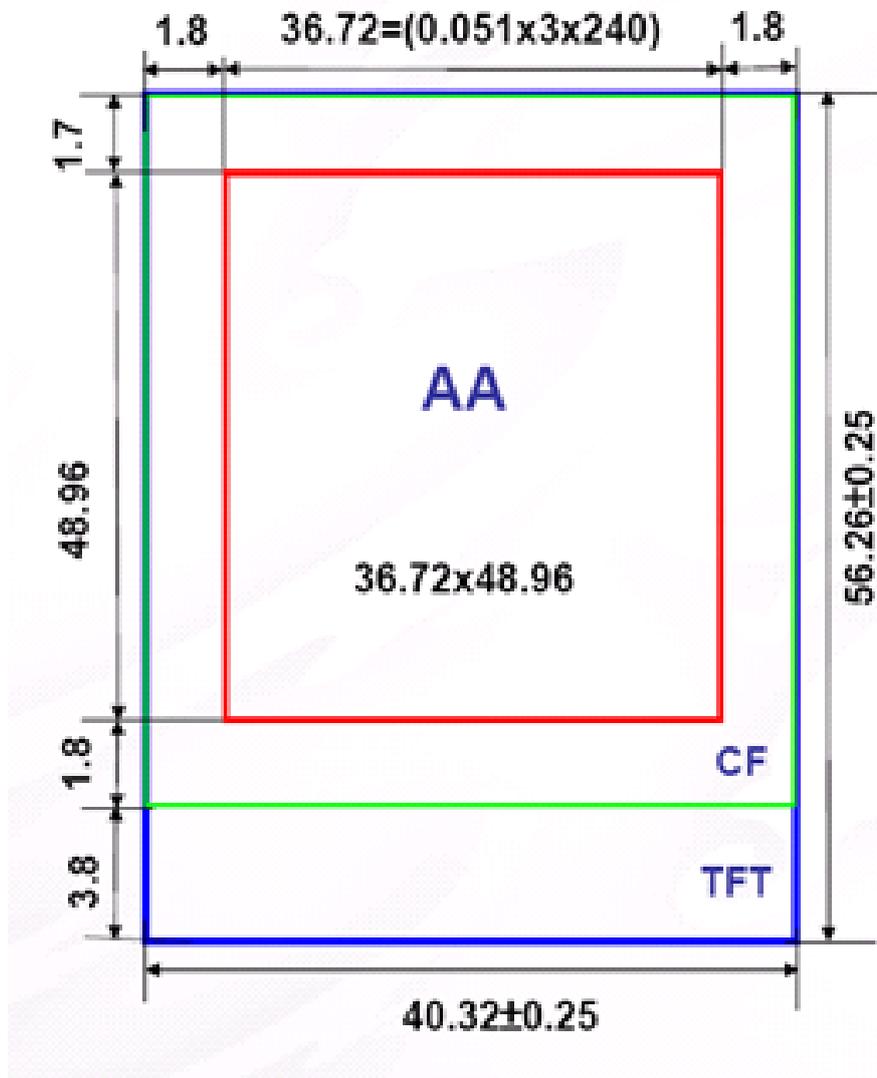Note (6) Reference C-light Spectrum

Figure 5 C-light Spectrum

Note (7) The polarizer type: Samsung/CF, Samsung /Array.

Note (8) All optical data based on IVO given polarizer & C-light& testing machine in this document.

6 Outline Size of Cell

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6.1 Outline Size of Single Chip

Unit: mm

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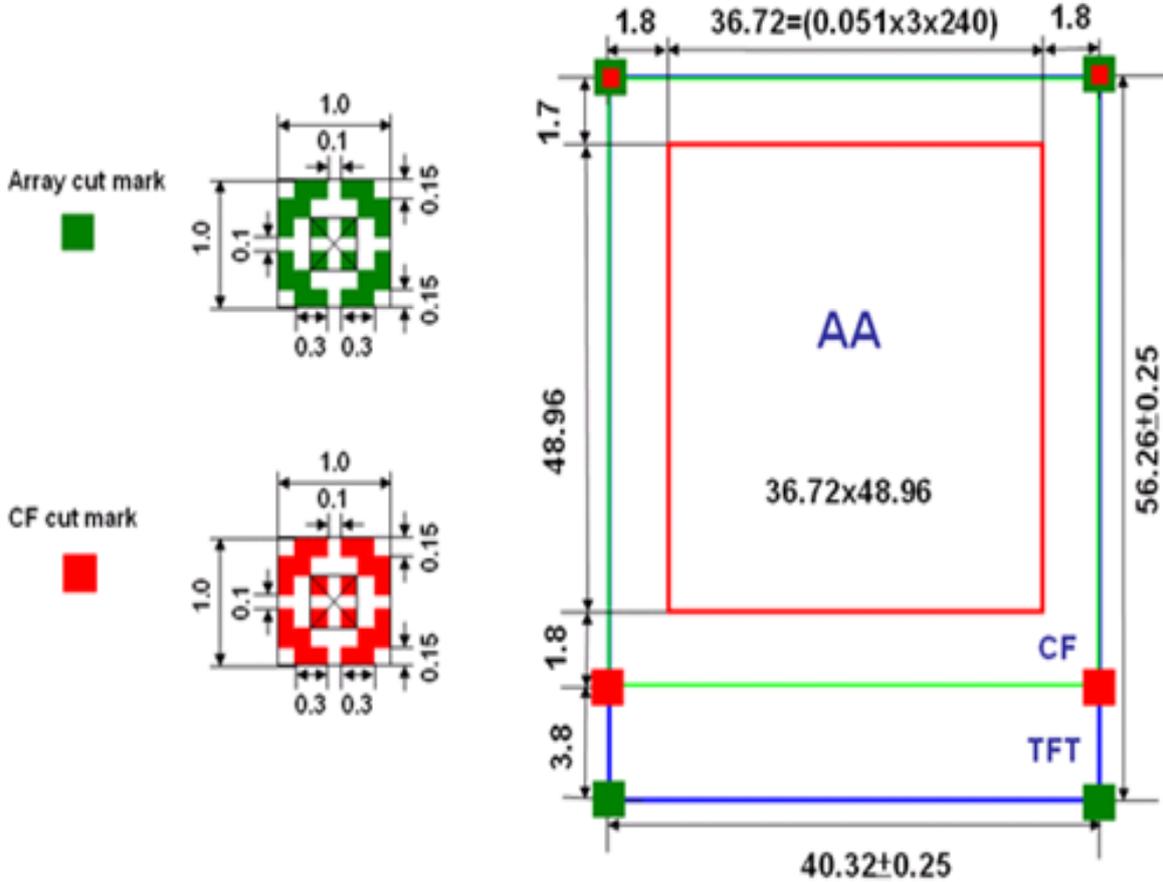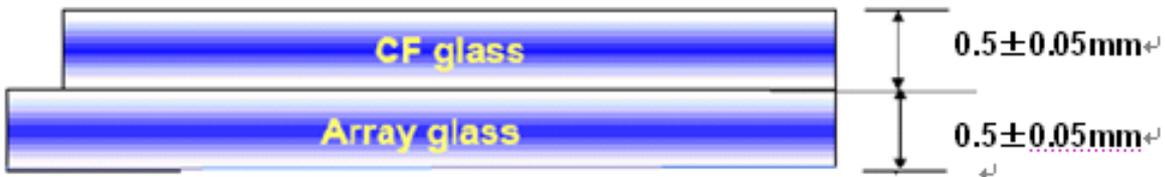## 6.2 Outline Size of Sub Chips and Cut Mark

Sub A: 100 chips

Sub A: 562.6mm*403.2mm

Unit: mm

Sub B: 90 chips

Sub B: 506.34mm*403.2mm

Unit: mm

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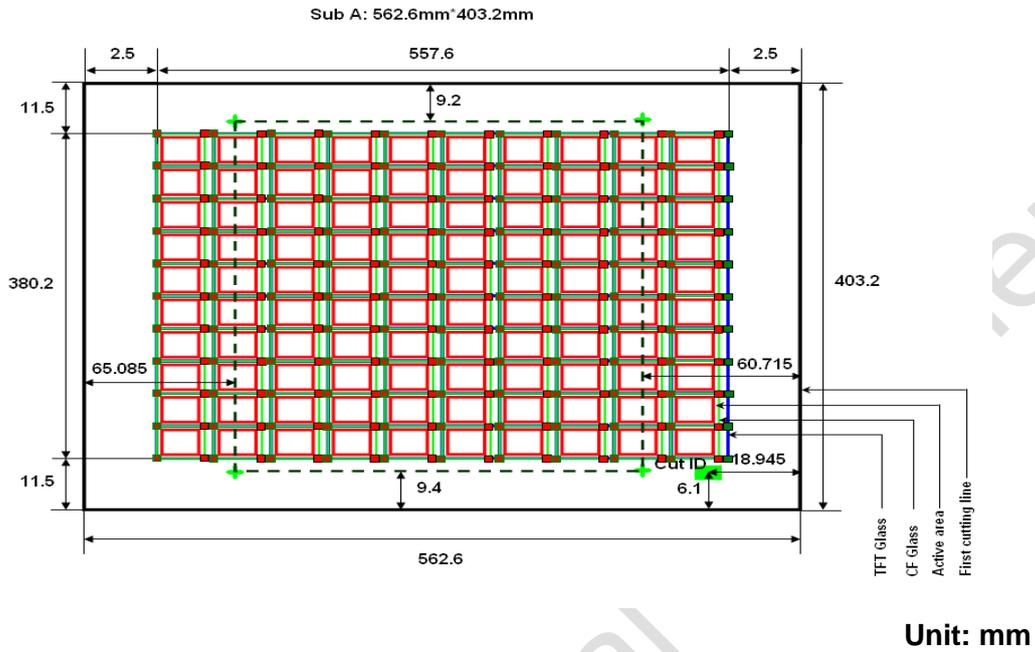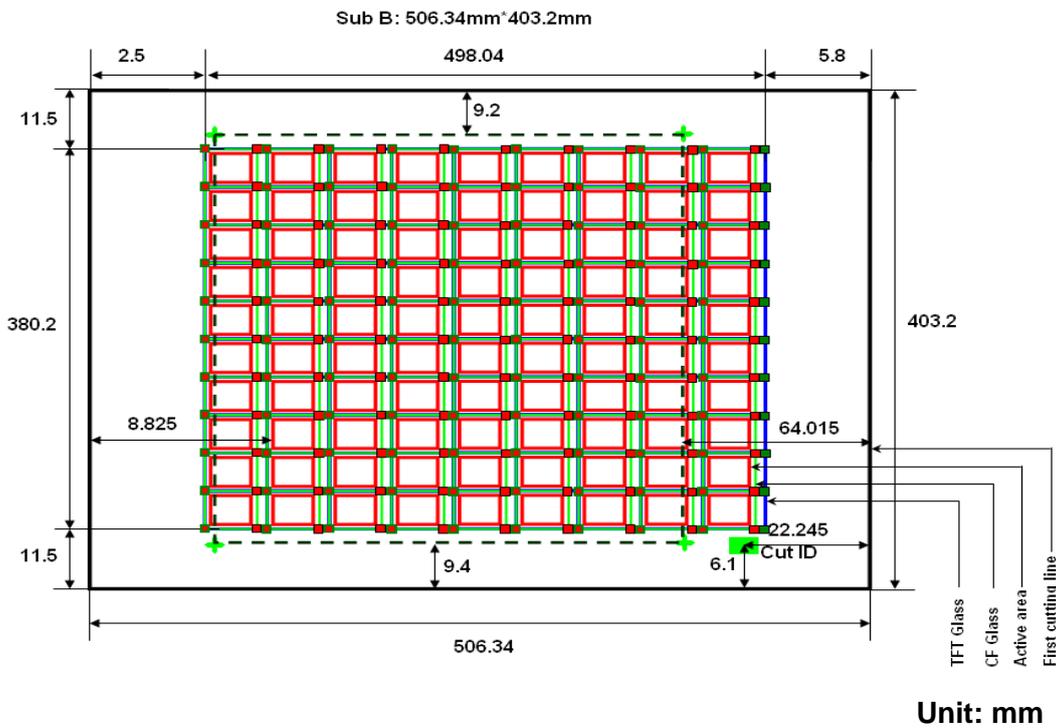
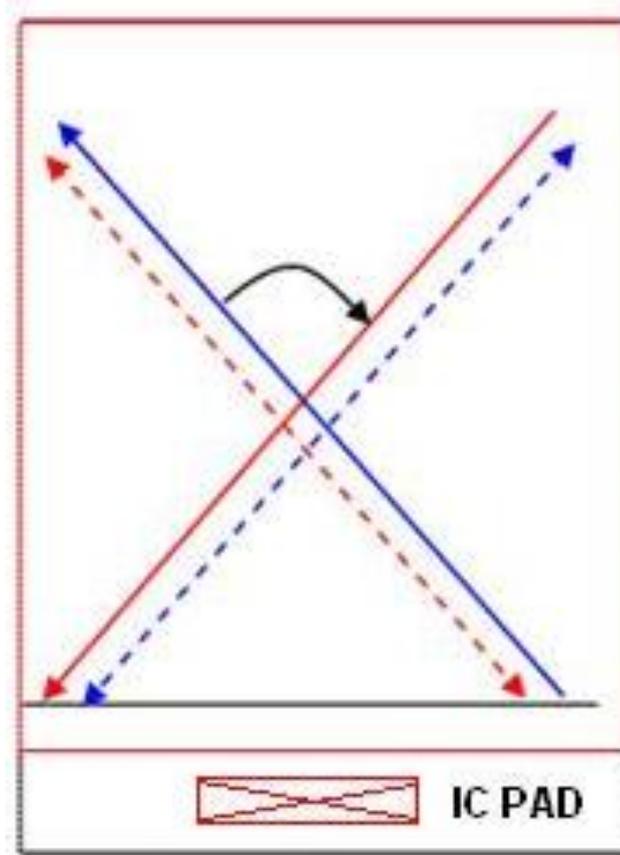| Document name	C024SN21-0 Customer Approval Specification	Page 11 of 27	
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Single Chip

Array cut mark

CF cut mark

Unit: mm

7   Cell Thickness

CF glass   0.5±0.05mm

Array glass   0.5±0.05mm

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8   CF/TFT Rubbing Direction

Rubbing Direction(12 o'clock)

Top view from CF protective film side

← – ▶   CF Absorption axis
← – ▶   TFT Absorption axis
————▶   TFT side rubbing direction
————▶   CF side rubbing direction

Item	Parameters
Absorption axis of	TFT side:45º
Polarizer	CF side:-45º

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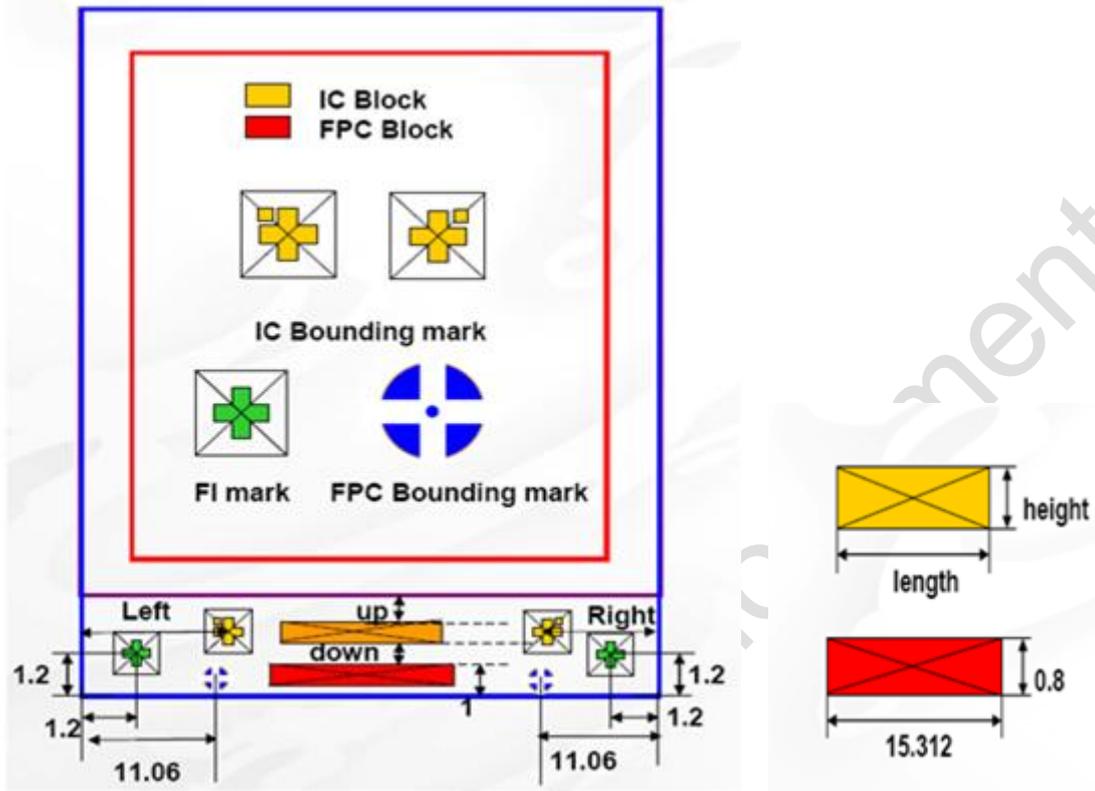## 9 Cell Light-On Information

9.1 Cell Light-On Test Pad Drawing
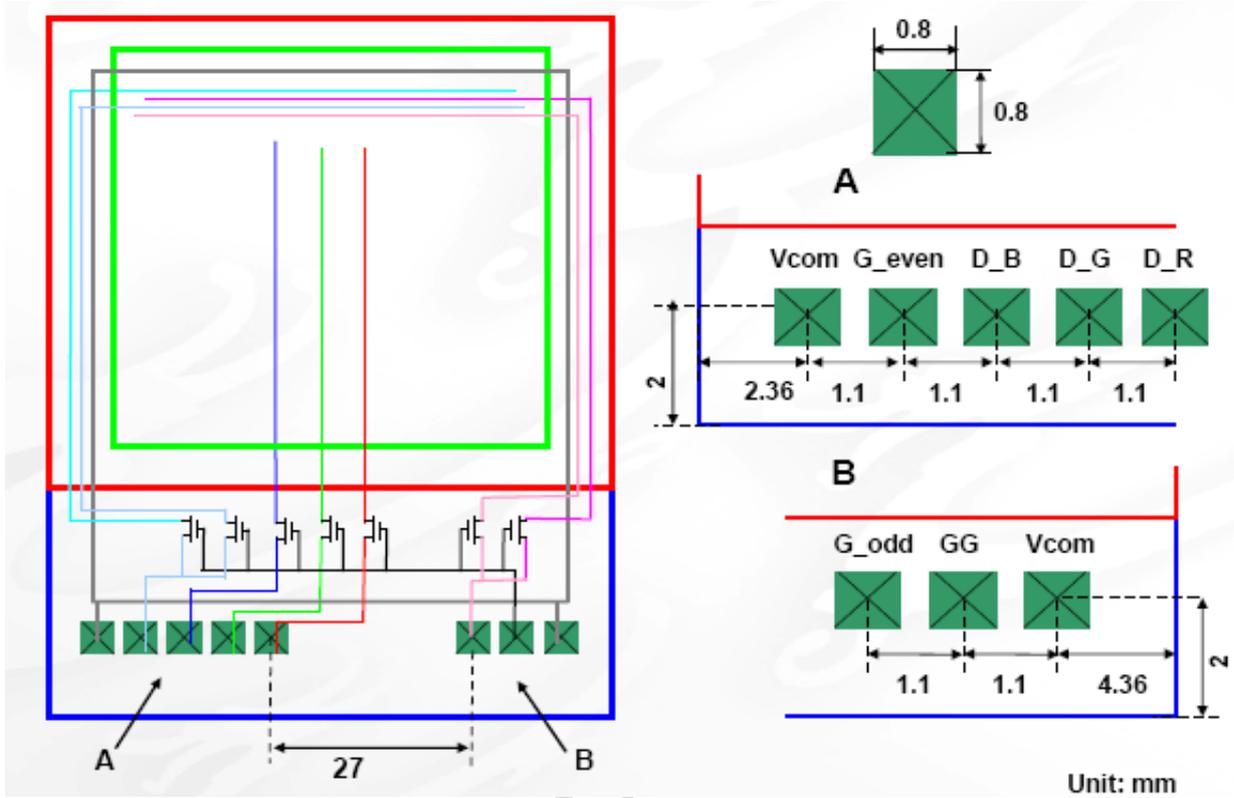
9.2 Cell Light-On Test Waveform

ⅠⅤⓞ InfoVision Optoelectronics (Kunshan) Co.,LTD.
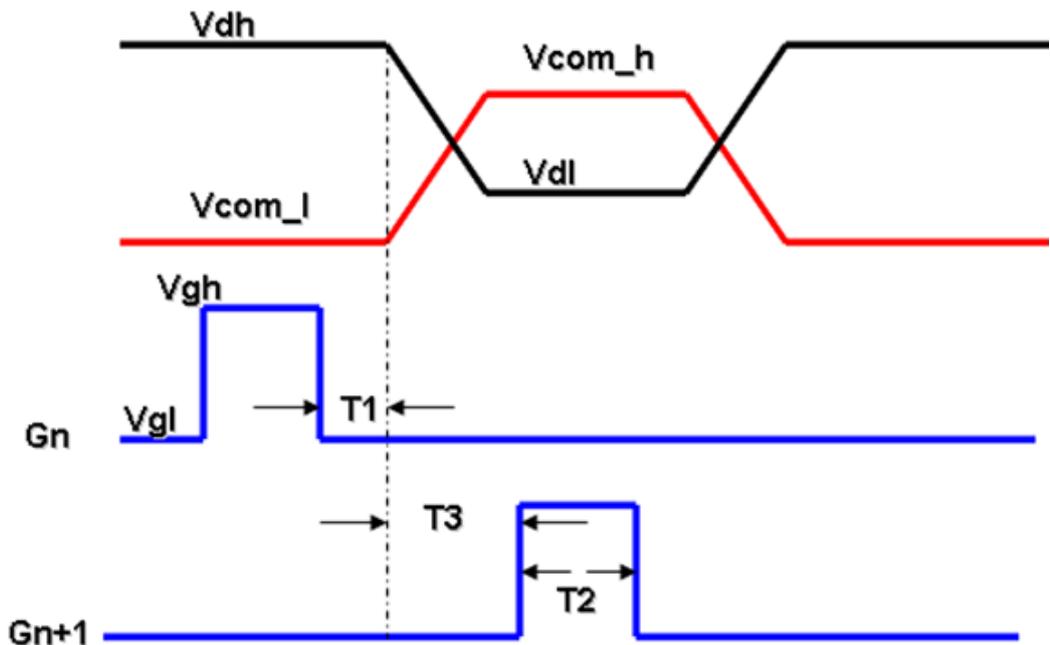
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10 COG+FPC Position On Panel

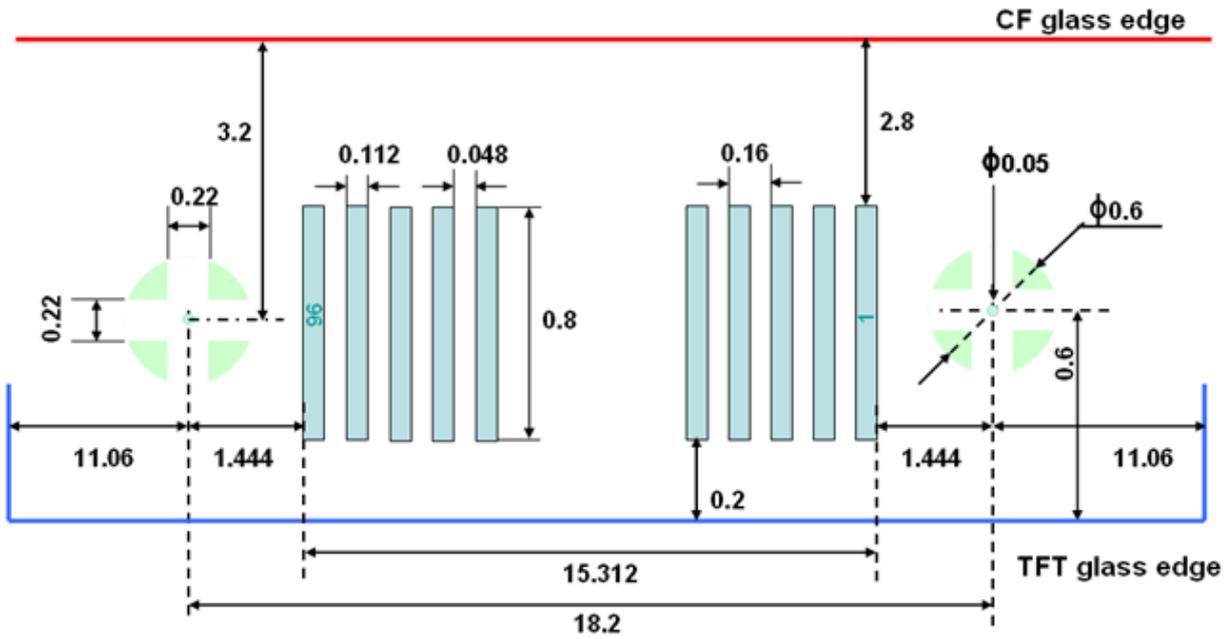**Unit: mm**

IC Name	Up(um)	Down(um)	Left(um)	Right(um)	Height(um)	Length(um)
ILI9341	1479	671	12680	12680	650	15860

11 FPC Pad Information

Unit: mm
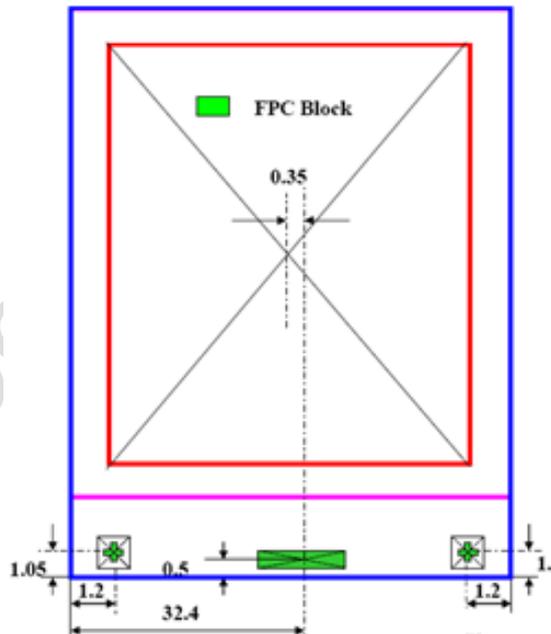
Unit: mm

12 Cell Electrode Pin Assignment

IVO InfoVision Optoelectronics (Kunshan) Co.,LTD.
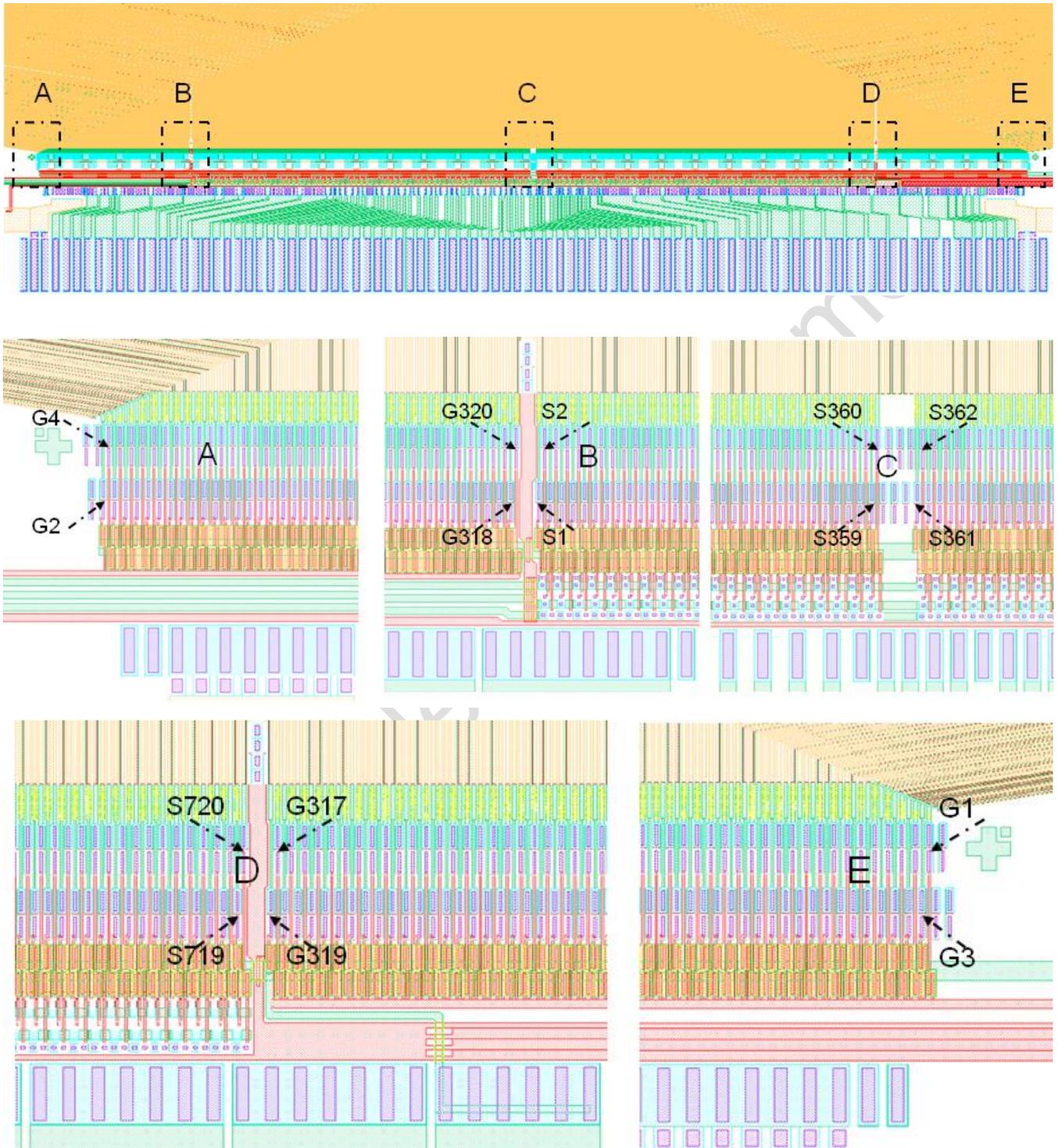
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12.1 FPC Pin Assignment

IC Mode：ILI9341

No.	Name	No.	Name	No.	Name	No.	Name
1	GND	25	VCI	49	DB0	73	DB[18]DUMMY
2	VCOM	26	VCI	50	DB1	74	DB[19]DUMMY
3	VCOM	27	VSS3	51	DB2	75	DB[20]DUMMY
4	C22P	28	VSS	52	DB3	76	DB[21]DUMMY
5	C22M	29	VSSC	53	DB4	77	DB[22]DUMMY
6	C21P	30	VSSA	54	DB5	78	DB[23]DUMMY
7	C21M	31	VSSA	55	DB6	79	VDDI
8	VGH	32	DUMMY	56	DB7	80	VDDI
9	VGH	33	VGS	57	DB8	81	VCORE
10	DUMMY	34	EXTC	58	DB9	82	VCORE
11	VGL	35	IM3	59	DB10	83	GVDD
12	VGL	36	IM2	60	DB11	84	VCL
13	DUMMY	37	IM1	61	DB12	85	VCL
14	AVDD	38	IM0	62	DB13	86	DUMMY
15	AVDD	39	RESE	63	DB14	87	DUMMY
16	C12P	40	CSX	64	DB15	88	(GND)
17	C12P	41	DCX	65	DB16	89	(GND)
18	C12M	42	WRX	66	DB17	90	DUMMY
19	C12M	43	RDX	67	DUMMY	91	DUMMY
20	C11P	44	VSYNC	68	TE	92	DUMMY
21	C11P	45	HSYNC	69	SDO	93	DUMMY
22	C11M	46	ENABLE	70	LEDPWM	94	VCOM
23	C11M	47	DOTCLK	71	LEDON	95	VCOM
24	GND	48	SDA	72	VDDI_LED	96	GND

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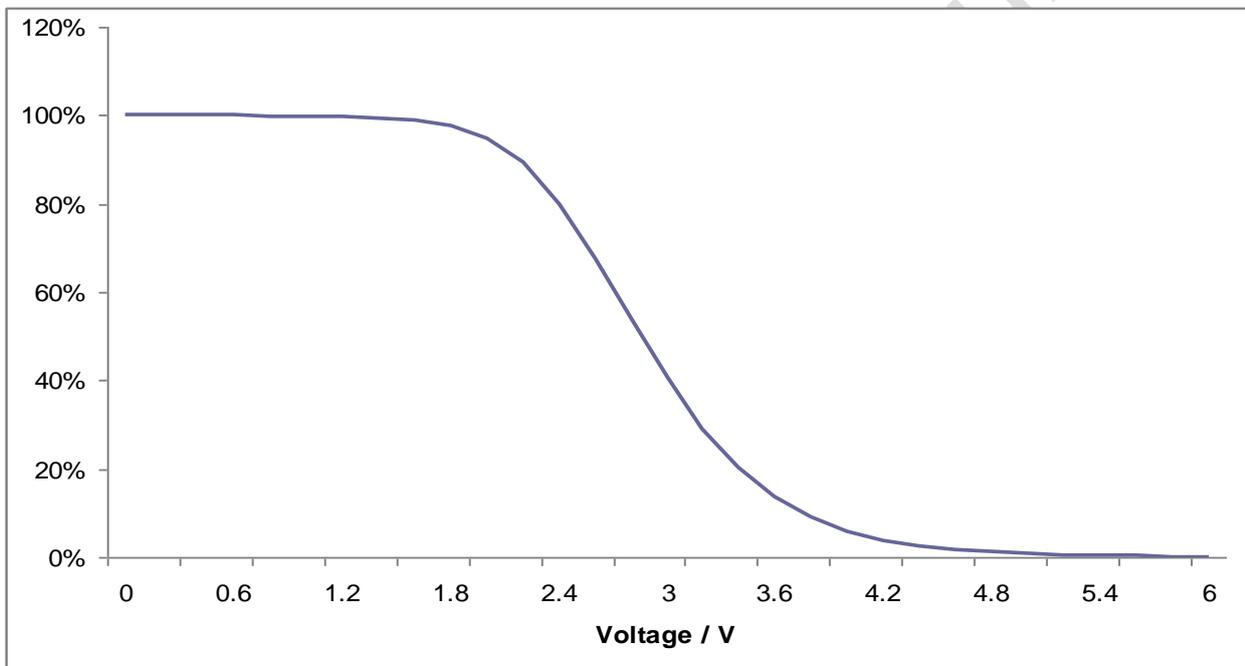| Document name	C024SN21-0 Customer Approval Specification		Page 18 of 27	
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12.2 FPC Pin Assignment Description

Pin Asignment	Description
GND	Ground
VCOM	The power supply of common voltage in TFT driving.
C22P	Connect the charge-pumping capacitor for generating VGH, VGL level.
C22M	Connect the charge-pumping capacitor for generating VGH, VGL level.
C21P	Connect the charge-pumping capacitor for generating VGH, VGL level.
C21M	Connect the charge-pumping capacitor for generating VGH, VGL level.
VGH	Power supply for the gate driver.
VGL	Power supply for the gate driver.
AVDD	Power supply for the gate driver.
C12P	Connect the charge-pumping capacitor for generating AVDD level.
C12M	Connect the charge-pumping capacitor for generating AVDD level.
C11P	Connect the charge-pumping capacitor for generating AVDD level.
C11M	Connect the charge-pumping capacitor for generating AVDD level.
VCI	High voltage power supply for analog circuit blocks (2.5 ~ 3.3 V)
VSS3	Digital ground
VSS	Digital ground
VSSC	Analog Ground
VSSA	Analog ground
EXTC	Interface format select pin
IM3-1	System interface select.
RESE	Reset pin.
CSX	Chip select signal.
DCX	(DNC) Command / parameter or display data selection pin.
WRX	(NWR) Write enable pin I80 parallel bus system interface.
RDX	(NRD) Read enable pin I80 parallel bus system interface.
VSYNC	Vertical synchronizing signal in RGB interface.
HSYNC	Horizontal synchronizing signal in RGB interface.
ENABLE	A data ENABLE signal in RGB I/F mode.
DOTCLK	Data enable signal in RGB interface.
SDA	Serial data input pin and output pin in serial bus system interface.
DB0-17	18-bit bi-directional data bus.
TE	Tearing effect output pin to synchronize MPU to frame writing,activated by S/W command.
SDO	Serial output signal.
LEDPWM	Output pin for PWM (Pulse Width Modulation) signal of LED driving.
LEDON	Output pin for enabling LED driving.

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| VDDI_LED	Power supply for LED driver interface.
DB[18-23] DUMMY	DUMMY
VDDI	Low voltage power supply for interface logic circuits
VCORE	Regulated Low voltage level for interface circuits
GVDD	High reference voltage for grayscale voltage generator.
VCL	Power supply for VCOML.
VCOM	Power supply pad for the TFT- display counter electrode.

13 V-T Curve

13.1 V-T Curve

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13.2 CF Spectrum
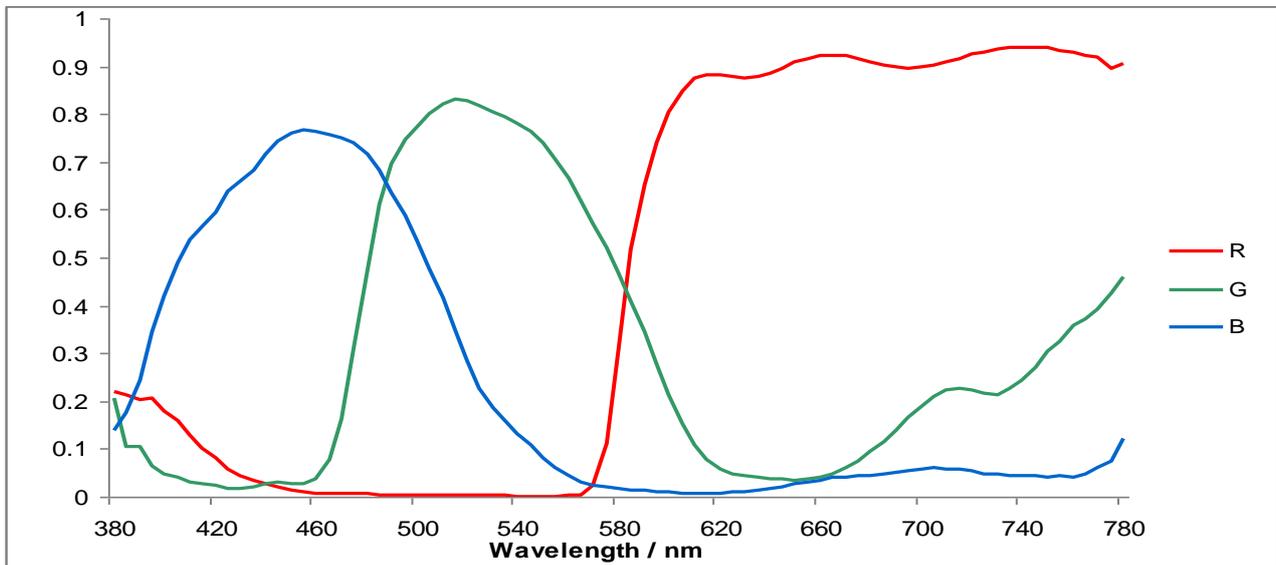
※ Measured at ambient temperature 25℃, under IVO requirement driving condition

14 IVO Requirement Driving Condition

14.1 Timing Range

Category	Parameter	Unit	Min.	Typ.	Max.
Timings	Frame Rate	Hz	-	60	-
Scanning Method	Gate Scanning Method (Single / Double)	Single			
Line Impedance	Capacitive Load of a Signal Line	pF	34.23	33.24	32.25
	Capacitive Load of a Gate Line	pF	57.73	54.14	50.63
	Resistance Load of Signal Line	KOhm	2.06	2.9	4.87
	Resistance Load of Gate Line	KOhm	0.65	0.76	0.92

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14.2 Power Supply Voltage

No.	Item	Min.	Typ.	Max.	Unit
1	Vcoml voltage	-2.2	-1.2	-0.2	V
1	Vcomh voltage	3.06	4.06	5.06	V
2	Vgl voltage	-10.3	-9.3	-8.3	V
3	Vgh voltage	10.5	11.5	12.5	V
5	Vdl voltage	-0.26	0.24	0.74	V
6	Vdh voltage	3.68	4.18	4.68	V
7	Gata line time [T2]	-	25.8	-	us
9	Data line pre-opening time [T3]	-	3.6	-	us
10	Data line delay closing time [T1]	-	6.8	-	us
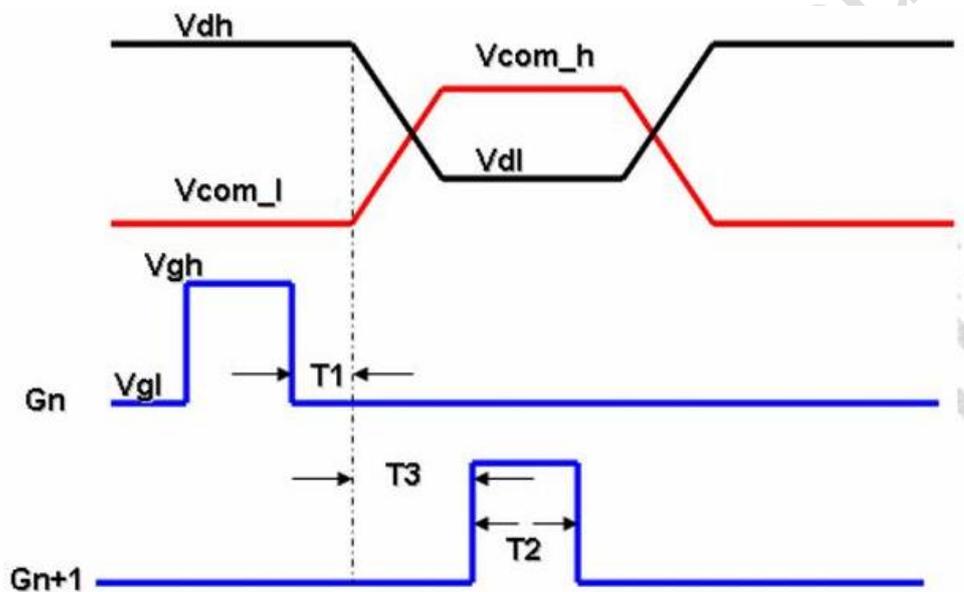
14.3 Panel Driving Condition

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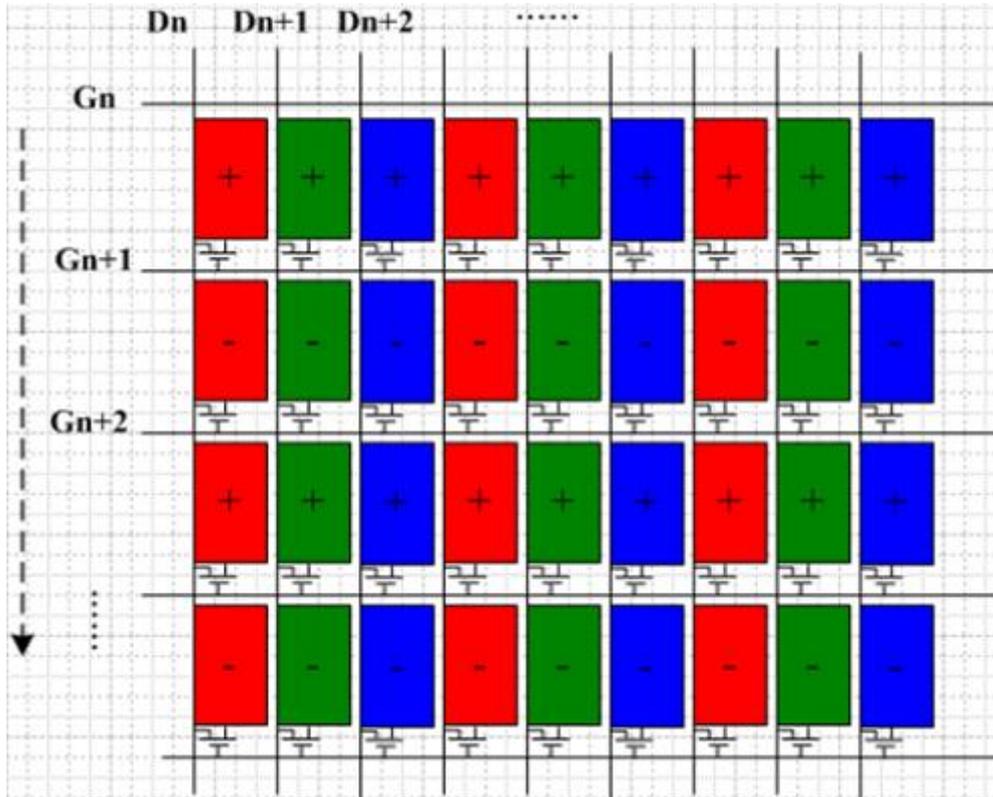
14.4 Gamma Reference Voltage:

ILI 9341 gamma Reference Voltage:

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14.5 OLB Outline

	Driver IC	Driver IC(Source Driver IC +T-con + GIP design)		
Item				

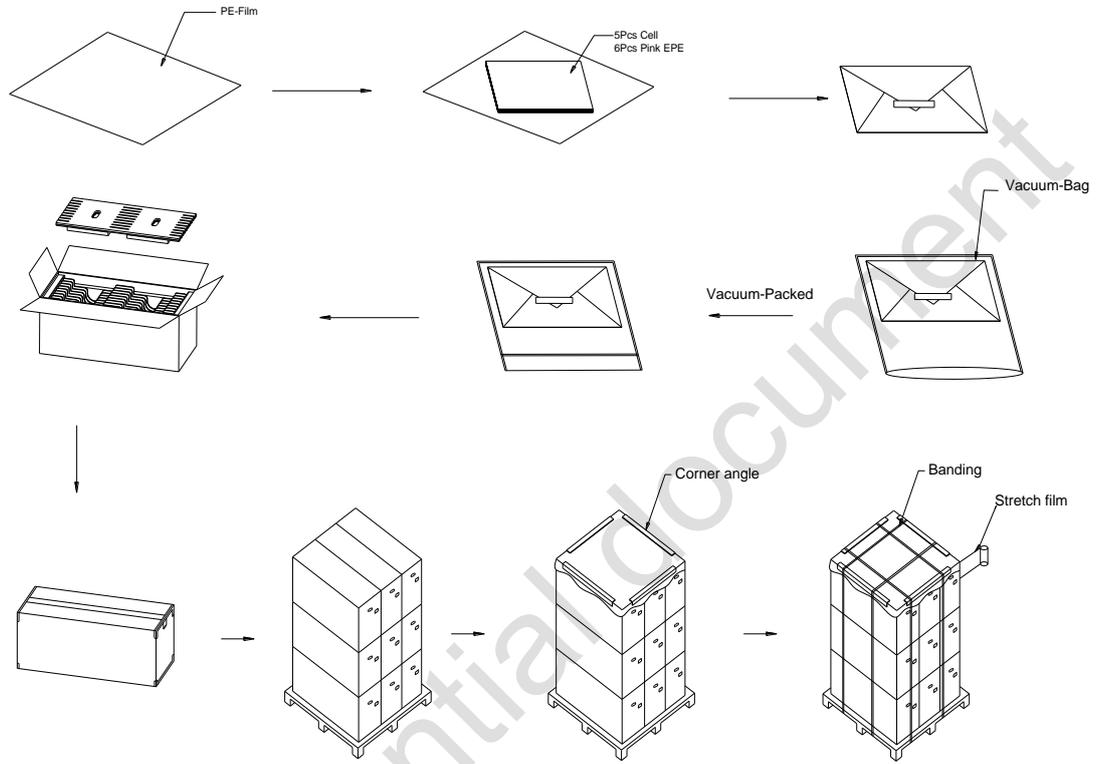| No.	Level	Positive	Negative	Unit
1	63	0.2585	3.9415	V
2	62	0.6785	3.6831	V
3	61	0.8077	3.5862	V
4	59	0.9864	3.4727	V
5	57	1.1294	3.4109	V
6	50	1.4332	3.2253	V
7	43	1.6477	3.1015	V
8	36	1.7753	2.9599	V
9	27	1.926	2.7081	V
10	20	2.1	2.4877	V
11	13	2.3358	2.1907	V
12	6	2.841	1.5968	V
13	4	3.1442	1.2999	V
14	2	3.6831	0.7431	V
15	1	4.0062	0.6139	V
16	0	4.2	0.2584	V
Output Channels		Gate 320/Source 720		
Driver Amount		1		
Component Type		COG		
OLB Pad Pitch		14um		

14.6 Driver Recommendation

Source Driver Supplier	ILITEK
Source Driver Model	ILI9341

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15 IVO Recommended Cell Packaging

15.1   100 Chips Package

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15.2 90 Chips Package
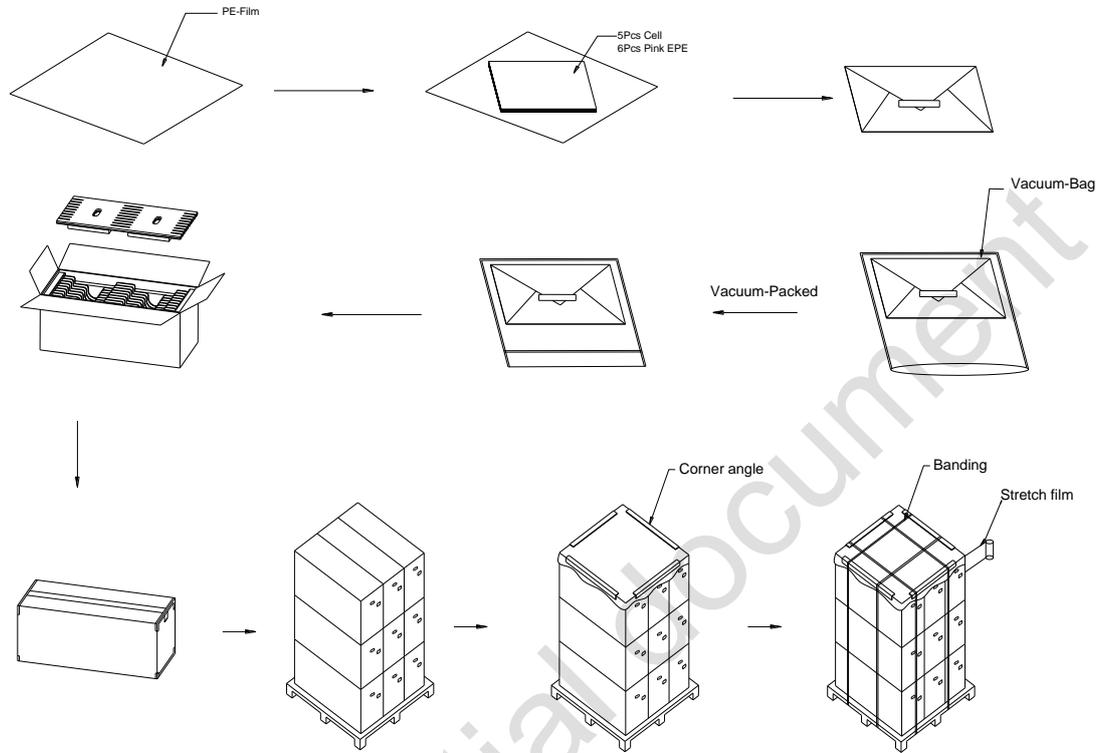
16 General Precaution

16.1 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.

16.2 Handling Precaution

(1) Since the LCD is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it fall a high place or receives a strong shock, the glass maybe broken.

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

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

(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.

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

16.3 Storage Precaution

(1) Please do not leave cell in the environment of high humidity and high temperature for long time.

(2) IVO suggests to assembly the cell to LCD module in one month after cut into single chip.

(3) The Cell should be stored in a dark place .Store in an ambient temperature of 5°C to 45°C,and in a relative humidity of 40% to 60%.Don't expose to sunlight or fluorescent light.

(4) Storage in a clean environment, free from dust, active gas, and solvent.

(5) Store in anti-static electricity container.

(6) Store without any physical load.

16.4 Caution For operation

(1) The Polarizer on the surface of panel are made from organic substance. Be very careful for chemicals not to touch the polarizer or it leads the polarizer to be deteriorated.

(2) Dot drop water or any chemicals onto the LCD's surface.

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

(4) Do not connect or disconnect the LCD to or from the system when power is on.

(5) When expose to drastic fluctuation of temperature(hot to cold or cold to hot）,the LCD may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCD's surface which may affect the operation of the polarizer and the LCD.

(6) Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure.

（7）The temperature of baking should be under 85℃.

IVO InfoVision Optoelectronics (Kunshan) Co.,LTD.

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16.5 Static Electricity

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

(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.

16.6 Safety

(1) For the crash damaged or unnecessary LCD, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol an should be burned up later.

(2) In the case the LCD is broken, watch out whether liquid crystal leaks out or not. If your hands touch the liquid crystal, wash your hands cleanly with water an soap as soon as possible.

(3) If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then drink a lot of water and induce vomiting, and then, consult a physician.

(4) If the liquid crystal should get in your eyes, flush your eyes with running water for at least fifteen minutes.

(5) If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.

16.7 Disposal

When disposing LCD module, obey the local environmental regulations.