Specification for 2.7''EPD

Model NO.: E027A52

Product VER: A1

Customer Approval

Customer	
Approval By	
Date Of Approval	

It will be agreed by the receiver, if not sign back the Specification within 15days.

Prepared By	Checked By	Approval By
黄志龙		

Version	Content	Date	Producer
A0	New release	2024/7/2	Eddie Huang
A1	Updated working condition	2025/1/2	Eddie Huang

CONTENTS

1.General Description 4
2.Features 4
3.Typical Application 4
4.Mechanial Specifications 5
5.Mechanical Drawing of EPD module 6
6.Input/output Terminals 7
7.Reference Circuit 9
8.Absolute Maximum Rating 11
9.DC Characteristics 11
10.Power Consumption 12
11.Optical Characteristics 12
11.1Optical Measurement Conditions 12
11.2Optical Measurement 12
11.3Definition of Contrast ratio 13
11.4Refection Ratio 13
12.Handling Safety And Environmental Requirements 15
13.Reliability Test 16
14.Block Diagram 17
15.Shipment Inspection Specification 17
15.1Zone Definition 17
15.2Line/Spot defect size 17
15.3Point and line standard 18
15.4Barcode 19
16.Packing 20

1. General Description

E027A52 is an Active Matrix Electrophoretic Display (AMEPD), with interface and a reference system design. The 2.7'' active area contains 176*264 pixels, and has B/W full display capabilities. An integrated circuit contains gate buffer, source buffer, interface, timing control logic, oscillator, DC-DC, SRAM, LUT, VCOM and border are supplied with each panel.

2. Features

- 176*264 pixels display
- High contrast
  High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable display
- Commercial temperature range
- Landscape, portrait modes
- Hard-coat antiglare display surface
- Ultra Low current deep sleep mode
- On chip display RAM
- Low voltage detect for supply voltage
- High voltage ready detect for driving voltage
- Internal temperature sensor
- Waveform stored in On-chip OTP
- 10-byte OTP space for module identification
- Serial peripheral interface available
- On-chip oscillator
- On-chip booster and regulator control for generating VCOM, Gate and Source driving voltage
- I2C signal master interface to read external temperature sensor/ built-in temperature sensor

3. Typical Application

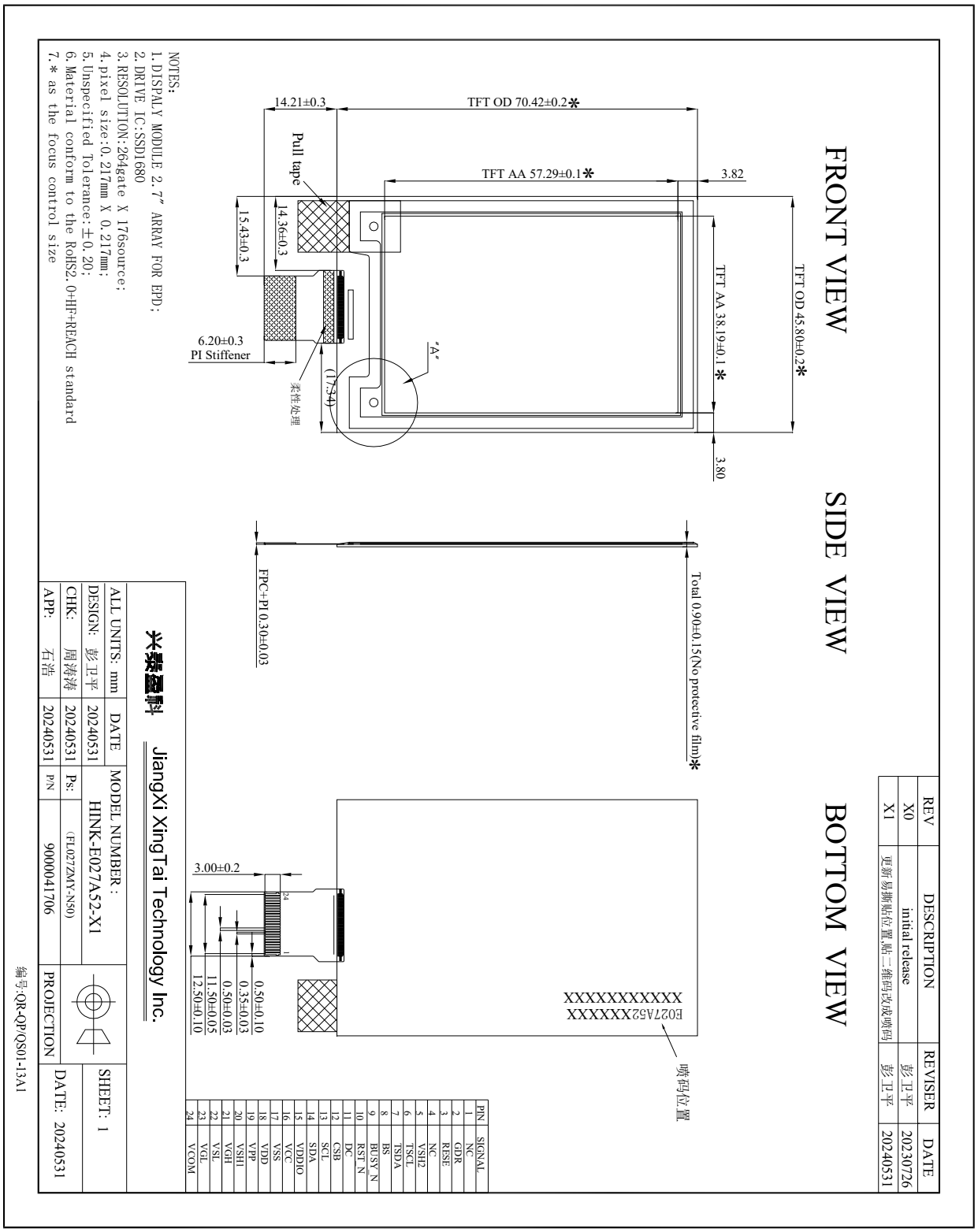
Electronic Shelf Label System

4. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	2.7	Inch	
Display Resolution	176(H)×264(V)	Pixel	Dpi:117
Active Area	38.19(H)×57.29(V)	mm	
Pixel Pitch	0.217*0.217	mm	
Pixel Configuration	Rectangle		
Outline Dimension	45.8(H)×70.42 (V) ×0.9(D)	mm	Without masking film
Weight	5.0±0.5	g	

File Name	Specification For 2.7'' EPD	Module Number	E027A52
Version	A1	Page Number	6 of 21

5. Mechanical Drawing of EPD module



6. Input/output Terminals

Pin #	Single	Description	Remark
1	NC	No connection and do not connect with other NC	Keep Open
2	GDR	This pin is N-MOS gate control.	
3	RESE	Current sense input for control loop.	
4	NC	No connection and do not connect with other NC	Keep Open
5	VSH2	Positive source voltage for Red	
6	TSCL	I2C clock for external temperature sensor	Connect to GND if not used
7	TSDA	I2C data for external temperature sensor	Connect to GND if not used
8	BS	Input interface setting.	Note 6-5
9	BUSY_N	This pin indicates the driver status.	Note 6-4
10	RST_N	Global reset pin	Note 6-3
11	DC	Serial communication Command/Data input	Note 6-2
12	CSB	Serial communication chip select.	Note 6-1
13	SCL	Serial communication clock input.	
14	SDA	Serial communication data input.	
15	VDDIO	IO voltage supply	
16	VCC	Digital/Analog power.	
17	VSS	Digital ground	
18	VDD	1.5V voltage input &output	
19	VPP	OTP program power (10V)	
20	VSH1	Positive source voltage	
21	VGH	Positive gate voltage	
22	VSL	Negative source voltage.	
23	VGL	Negative gate voltage.	
24	VCOM	VCOM driving voltage	

1. Note 6-1: This pin (CSB) is the chip select input connecting to the MCU. The chip is enabled for MCU communication: only when CSB is pulled LOW.

2. Note 6-2: This pin (DC) is Data/Command control pin connecting to the MCU. When the pin is pulled HIGH, the data will be interpreted as data. When the pin is pulled LOW, the data will be interpreted as command.

3. Note 6-3: This pin (RST_N) is reset signal input. The Reset is active low.

4. Note 6-4: This pin (BUSY_N) is busy state output pin. When Busy is High, the operation of chip should not be interrupted and any commands should not be issued to the module. The driver IC will put Busy pin High when the driver IC is working such as: Outputting display waveform; Communicating with digital temperature sensor

5. Note 6-5: This pin (BS) is for 3-line SPI or 4-line SPI selection. When it is “Low”, 4-line SPI is selected. When it is “High”, 3-line SPI (9 bits SPI) is selected.

7. Reference Circuit

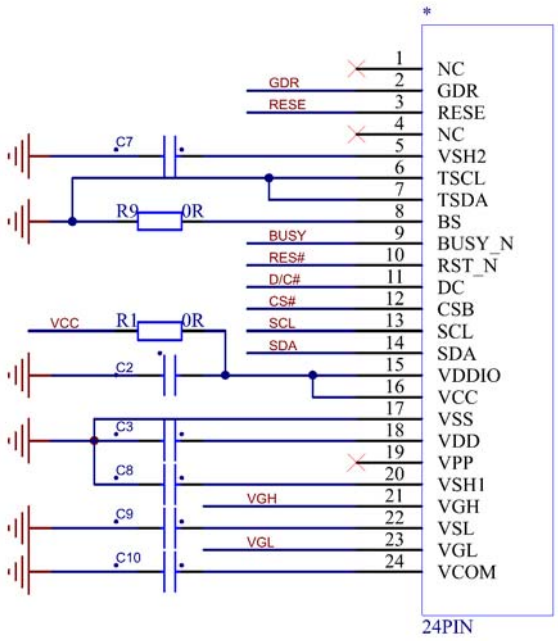


Figure. 7-1

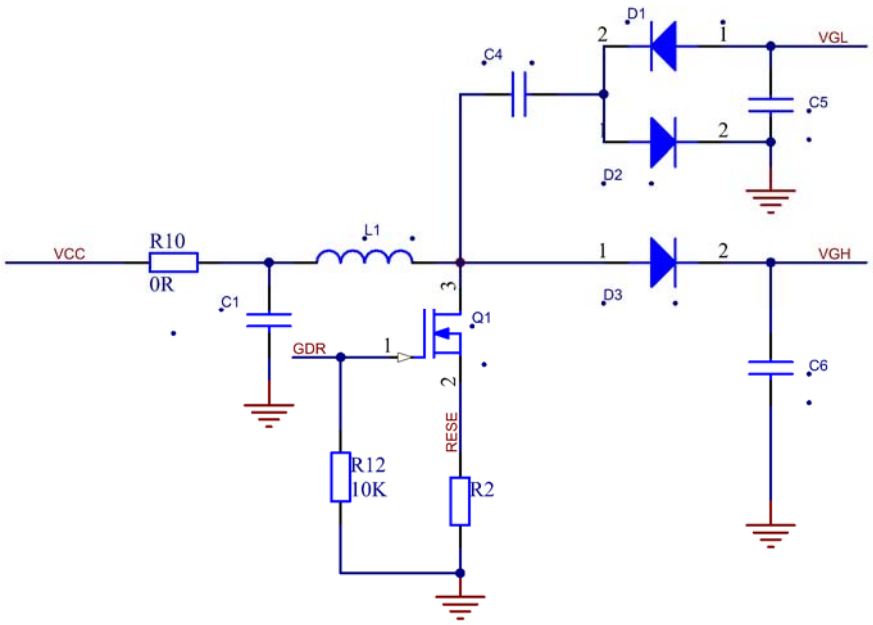


Figure. 7-2

Table. 7-3

Part Name	Value/Type	SSD1680Value /requirement/Reference Part
C0-C1	1uF	X5R/X7R; Voltage Rating : 6V or 25V
C2-C7	1uF	0402/0603/0805; X5R/X7R; Voltage Rating : 25V
C8	0.47uF, 1uF	0402/0603/0805; X5R/X7R; Voltage Rating : 25V
R1	2.2 ohm	0402/0603/0805; 1% variation, 0.05W
D1-D3	Diode	MBR0530 1) Reverse DC voltage 30V 2) Io:500mA 3) Forward voltage ≤ 430mV
Q1	NMOS	Si1304BDL/NX3008NBK 1） Drain-Source breakdown Voltage=30V（min） 2） Vgs(th)=0.9V(Typ),1.3V(Max) 3） Rds on ≤2.1Ω & Vgs=2.5V
L1	47uH	CDRH2D18/LDNP-470NC Io=500(Max)
CON24Pin	0.5mm ZIF Socket	24Pins,0.5mm pitch

8. ABSOLUTE MAXIMUM RATING

Parameter	Symbol	Rating	Unit	Humidity	Unit	Note
Logic Supply voltage	VCC,VDDIO	-0.5~6.0	V	45~70	%RH	Note 8-1
Operation temperature range	TOPR	0~50	°C	45~70	%RH	
Storage temperature range	TSTG	-25~60	°C	45~70	%RH	Note 8-2
Transportation temperature range	TTTG	-25~60	°C	45~70	%RH	Note 8-3
GND	Ground	-	-		-	Connect to Ground

Note 8-1: Maximum ratings are those values beyond which damages to the device may occur. VCC: Digital power, VDDIO: IO power. Functional operation should be restricted to the limits in the Electrical Characteristics chapter.
Note 8-2: The display effect may be affected if the product is stored for more than 10days under the environment of above 60 degree. The recommended long storage temperature is 10℃~30℃.
Note 8-3: TTTG is the transportation condition, the transport time is within 10 days for -25℃~0℃/40℃~60℃ or within 5 days for 60℃~70℃
Note 8-4: The single pixel effect under the condition of above 35 degree cannot be guaranteed. The product can operate under the temperature -15~0℃ or 50~65℃, but the display effect cannot be guaranteed.

9. DC Characteristics

The following specifications apply for: VSS=0V, VCC=3.0V, TOPR=25±2℃.

Symbol	Parameter	Test Condition	Applicable pin	Min.	Typ.	Max.	Unit
VCC	VCC operation voltage	-	VCC	2.4	3.0	3.6	V
VIH	High level input voltage	-	SDA, SCL, CS#, D/C#, RES#, BS1	0.8VDDIO	-	-	V
VIL	Low level input voltage	-		-	-	0.2VDDIO	V
VOH	High level output voltage	IOH = -100uA	BUSY,	0.9VDDIO	-	-	V
VOL	Low level output voltage	IOL = 100uA		-	-	0.1VDDIO	V
Iupdate	Module operating current	-	-	-	-	8	mA
Isleep	Deep sleep mode	VCC=3.0V	-	-		3	uA

- The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by XingTai.
- VCOM value will be OTP before in factory.

10. Power Consumption

Parameter	Symbol	Conditions	TYP	Max	Unit	Remark
Panel power consumption during update	-	25℃		80	mAs	-

MAs=update Average current ×update time

The Typical power consumption is measured using associated 25℃waveform with following pattern:

11. Optical characteristics

11.1 Optical Measurement Conditions

Item	Symbol	Value	Unit	Note
Ambient Temperature	Ta	25±2	℃	Indoor testing
Ambient Humidity	Ha	50±5	%RH	-
Supply Voltage	VCC, VDDIO	3.0	V	-
illuminance	-	800~1300	Lux	

Note 11-1: Image is updated with above condition

11.2 Optical Measurement

WS: White state, BS: Black state, RS: Red state

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX	UNIT	Note
△E	ghosting	-	-	-	2		-
BS	Black State L* value		-	-	20		Note 11-2
WS	White State L* value		66	-	-		Note 11-2

Note 11-2: Luminance meter: Eye - One Pro Spectrophotometer

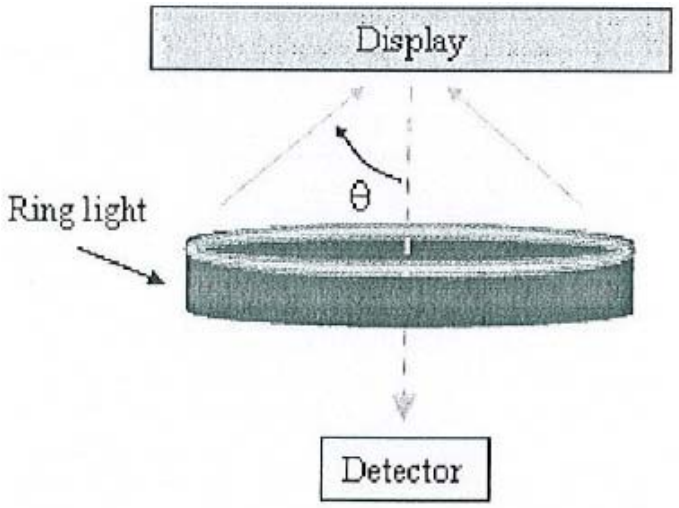
Note 11-3:We don't guarantee 5 years pixels display quality for humidity below 45%RH or above 70%RH；Suggest Updated once a day;

Note 11-4: To increases the black and white screen clear screen when red has refreshed for a long time , the effect is better。

11.3 Definition of contrast ratio

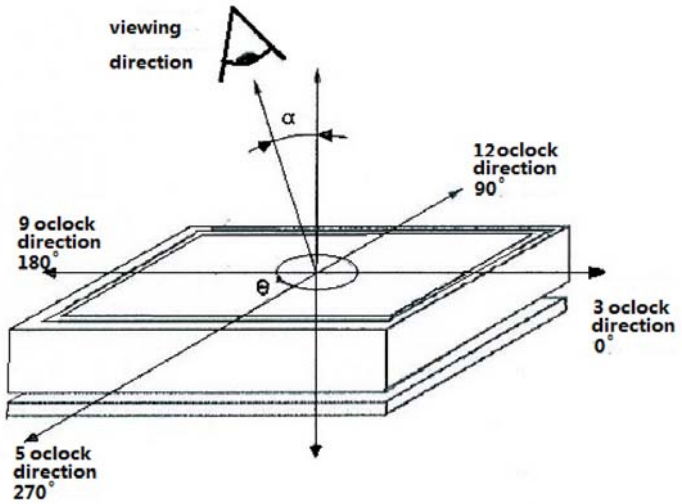
The contrast ratio (CR) is the ratio between the reflectance in a full white area (Rl) and the reflectance in a dark area (Rd)： R1: white reflectance Rd: dark reflectance

CR = Rl/Rd



11.4 Reflection Ratio

The reflection ratio is expressed as:
R = Reflectance Factor white board x (L center / L white board)
L center is the luminance measured at center in a white area (R=G =B=1). L white board is the luminance of a standard white board. Both are measured with equivalent illumination source. The viewing angle shall be no more than 2 degrees.



12. Handling Safety and Environmental Requirements

WARNING
The display module should be kept flat or fixed to a rigid, curved support with limited bending along the long axis. It should not be used for continual flexing and bending. Handle with care. Should the display break do not touch any material that leaks out. In case of contact with the leaked material then wash with water and soap.

CAUTION
The display module should not be exposed to harmful gases, such as acid and alkali gases, which corrode electronic components.
Disassembling the display module can cause permanent damage and invalidate the warranty agreements.
IPA solvent can only be applied on active area and the back of a glass. For the rest part, it is not allowed.
Observe general precautions that are common to handling delicate electronic components. The glass can break and front surfaces can easily be damaged. Moreover the display is sensitive to static electricity and other rough environmental conditions.

Mounting Precautions
(1) It`s recommended that you consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module.
(2) It`s recommended that you attach a transparent protective plate to the surface in order to protect the EPD. Transparent protective plate should have sufficient strength in order to resist external force.
(3) You should adopt radiation structure to satisfy the temperature specification.
(4) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the PS at high temperature and the latter causes circuit break by electro-chemical reaction.
(5) Do not touch, push or rub the exposed PS with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of PS for bare hand or greasy cloth. (Some cosmetics deteriorate the PS)
(6) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach the PS. Do not use acetone, toluene and alcohol because they cause chemical damage to the PS.
(7) Wipe off saliva or water drops as soon as possible. Their long time contact with PS causes deformations and color fading.

Data sheet status

Product specification	The data sheet contains final product specifications.

Limiting values
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.
Application information
Where application information is given, it is advisory and dose not form part of the specification.

Product Environmental certification
ROHS
REMARK
All The specifications listed in this document are guaranteed for module only. Post-assembled operation or component(s) may impact module performance or cause unexpected effect or damage and therefore listed specifications is not warranted after any Post-assembled operation.

13. Reliability test

13.1 Reliability test items

	TEST	CONDITION	METHOD	REMARK
1	High-Temperature Operation	T=40℃，RH=35%RH，For 240Hr		
2	Low-Temperature Operation	T = 0℃ for 240 hrs		
3	High-Temperature Storage	T=60℃ RH=35%RH For 240Hr Test in white pattern		
4	Low-Temperature Storage	T = -25℃ for 240 hrs Test in white pattern		
5	High Temperature, High-Humidity Operation	T=40℃，RH=90%RH，For 168Hr		
6	High Temperature, High-Humidity Storage	T=60℃，RH=80%RH，For 240Hr Test in white pattern		
7	Temperature Cycle	-25℃(30min)~70℃(30min)，50 Cycle Test in white pattern		
8	Package Vibration	1.04G,Frequency : 10~500Hz Direction : X,Y,Z Duration:1hours in each direction	Full packed for shipment	
9	Package Drop Impact	Drop from height of 100 cm on Concrete surface Drop sequence:1 corner, 3edges, 6face One drop for each.	Full packed for shipment	
10	UV exposure Resistance	765 W/㎡ for 168hrs,40℃		
11	ESD test	Operation/Non-operation, contact mode ±2KV/Air mode ±8KV		

Actual EMC level to be measured on customer application.

Note1：Stay white pattern for storage and non-operation test.

Note2：Power off duration time is 30s

Note3：The function, appearance, optical should meet the requirements of the test before and after the test.

Note4：Continue testing after 2 hours at 20C~25C℃

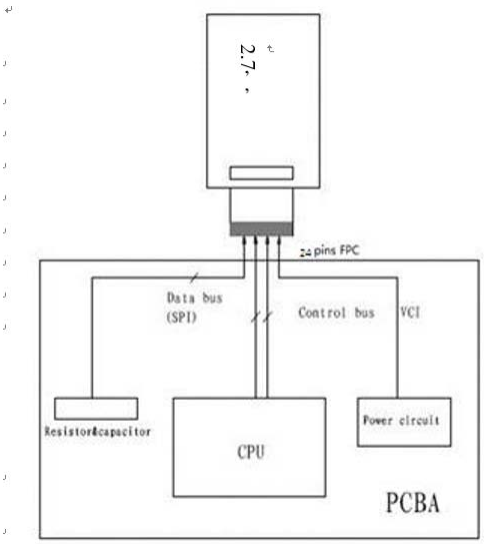
13.2 Product life time

The EPD Module is designed for a 5-year life-time with 25 ℃/60%RH operation assumption. Reliability estimation testing with accelerated life-time theory would be demonstrated to provide confidence of EPD lifetime.

13.3 Product warranty

Warranty conditions have to be negotiated between Xingtai and individual customers. Xingtai provides 12+1(one month delivery time) months warranty for all products which are purchased from Xingtai.

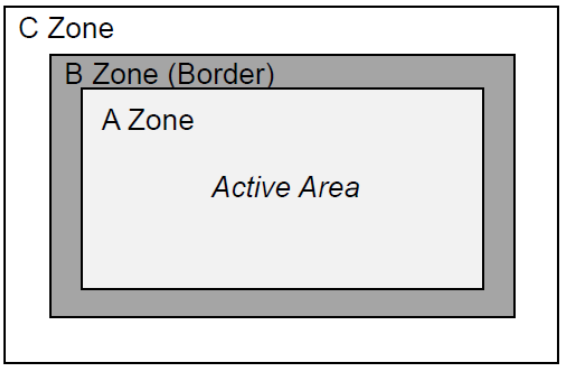
14. Block Diagram



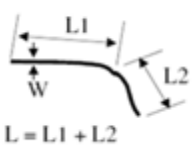
15. Shipment inspection specification

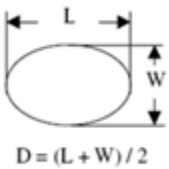
15.1 Zone Definition

A Zone: Active Area
B Zone: Border Area
C Zone: From B Zone edge to panel edge

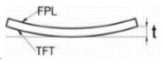


15.2 Line/Spot defect size





15.3 Point and line standard

Shipment Inspection Standard						
Equipment：Electrical test fixture, Point gauge						
Outline dimension	45.8(H)×70.42 (V) ×0.9(D)	**Unit：** ㎜	**Part-A**	Active area	**Part-B**	Border area
Environment	**Temperature**	**Humidity**	**illuminance**	**Distance**	**Time**	**Angle**
	19℃～25℃	50±5%RH	800~1300Lux	300 ㎜	35Sec	45°
Defect type	**Inspection method**	**Standard**		**Part-A**		**Part-B**
FPL/Spot	Visual/Film card	D≤0.25 ㎜		Ignore		Ignore
		0.25 ㎜＜D≤0.4 ㎜		N≤4		Ignore
		D＞0.4 ㎜		Not Allow		Ignore
FPL/Damage	Visual/Film card	L≤2, W≤0.1mm		N≤4		Ignore
		2mm<L≤5mm, 0.1mm<W≤0.3mm		N≤1		Ignore
		L>5mm, W>0.3mm		Not Allow		Ignore
FPL/Dirt	Visual/Film card	L≤1, W≤0..03mm		Ignore		Ignore
		0.03mm<W≤0.25mm; L≤4		N≤4		Ignore
		L>4mm, W>0.25mm		Not Allow		Ignore
Display malfunction	Electric Display	Not Allow		Not Allow		Ignore
Display error	Electric Display	Not Allow		Not Allow		Ignore
TFT Scratch or line defect(include dirt)	Visual/Film card	L≤2 ㎜,W≤0.2 ㎜		Ignore		Ignore
		2.0mm＜L≤9.0mm,0.2＜ W≤0.3mm,		N≤4		Ignore
		L＞9 ㎜,W＞0.3 ㎜		Not Allow		Ignore
TFT Corner /Edge chipping	Visual/Film card	X≤6mm,Y≤0.4mm, Do not affect the electrode circuit (Edge chipping) Ignore X≤1mm,Y≤1mm, Do not affect the electrode circuit((Corner chipping) Ignore 				
TFT warping	For 1.54~7.5inch, T≤2mm; For above 7.5inch, T≤3mm 					

PS/bubble	Visual/Film card	D≤0.2mm	Ignore	Ignore
		0.42<D≤0.3mm	N≤4	Ignore
		D>0.3mm	Not Allow	Ignore
PS/Dirt	Visual/Film card	L≤1 ㎜,W≤0.03 ㎜	Ignore	Ignore
		L≤4 ㎜,0.03<W≤0.25 ㎜	N≤4	Ignore
		W>0.25mm; L>4mm	Not Allow	Ignore
PS/Scratch	Visual/Film card	L≤2 ㎜,W≤0.1 ㎜	N≤4	Ignore
		2mm<L≤4 ㎜,W≤0.3 ㎜	N≤2	Ignore
		W>0.3mm; L>4mm	Not Allow	Ignore
Remark	1.Cannot be defect & failure cause by appearance defect;			
	2.Cannot be larger size cause by appearance defect;			
	L=long W=wide D=point size N=Defects NO			

15.4 Barcode

FF

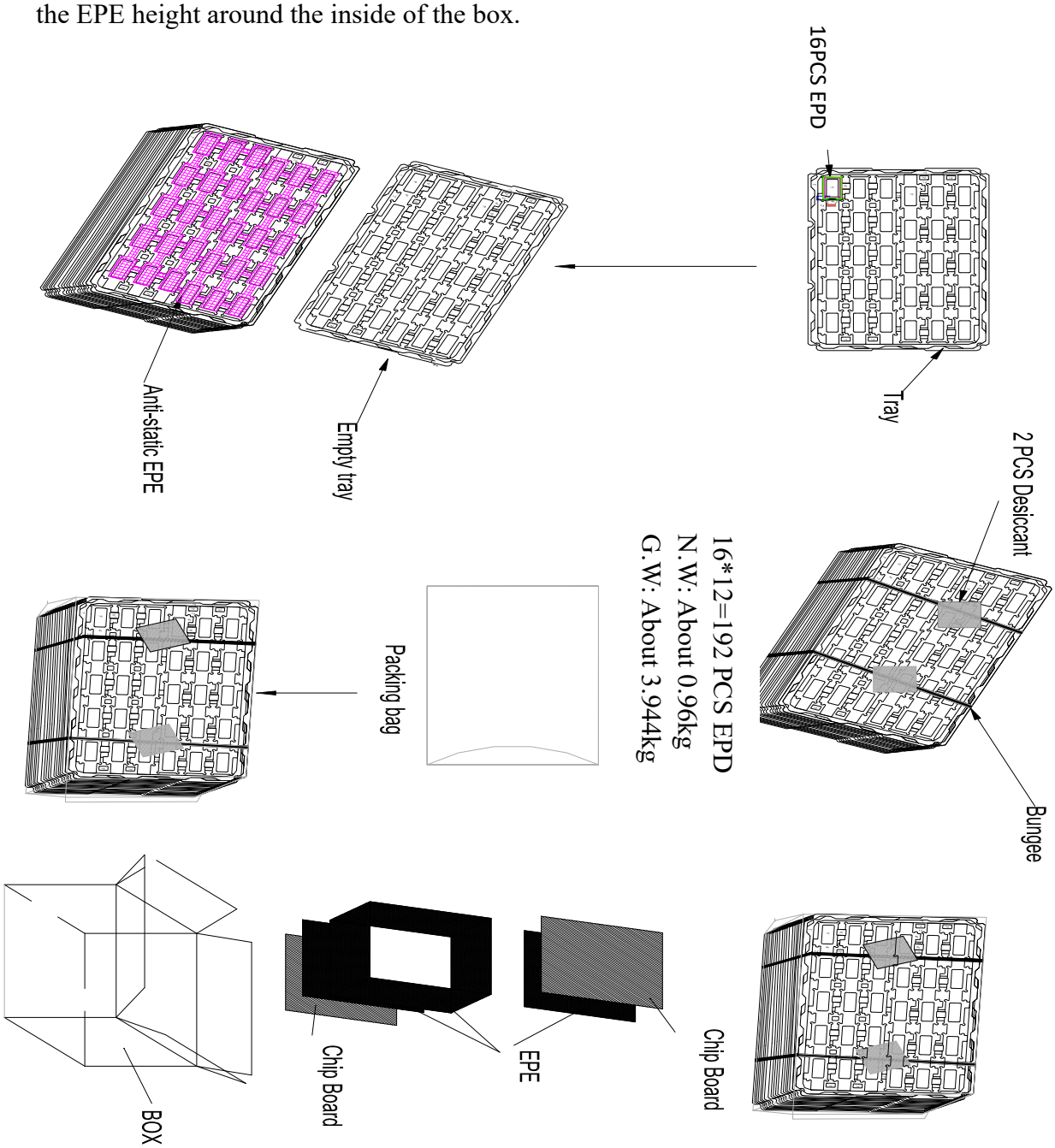
ABBBBBBBBB

CCCDDDEEEE

What is the QR code after picture being scanned and read? It consist of 30 numbers and letters, here is explanation for it.

QR Code: ABBBBBBBBBFFCCCDDDEEEEGHIJKKLL

① A means Factory code, e.g.: H (HINK)
② BBBBBBBBB refers to product model name, which is in consistent with specification part number. E.g.: E0213A189 or E0266A120; when the total code is less than 9, it would be added suffix with **. e.g.: E027A45** or E0154A78*
③ FF means production workshop
④ CCC means date of production
⑤ DDD means production batch
⑥ EEEE means FPL lot
⑦ G means MP/Sample/Trial/Repair
⑧ HIJ:(H——TFT;I——PS;J——EC Glue)
⑨ KK means IC type
⑩ LL means serial number

16. Packing

Full carton: 12 pcs tray with products and 1 pcs empty tray.
Last carton: less 12pcs tray with products and 1 pcs empty tray. The packager will add the right amount of EPE to box so that the added EPE's height approximately close to the EPE height around the inside of the box.