EPD Module Specification

Module NO.：TSE037A56-BWRY

Version：V1.0

□ APPROVAL FOR SPECIFICATION   □ APPROVAL FOR SAMPLE

For Customer's Acceptance：	
Approved by	**Comment**

Team Source Display：		
Presented by	**Reviewed by**	**Approved by**

Version	Content	Date	Producer
A0	New release	2025/9/29	

CONTENTS

1. **General Description**

TSE037A56-BWRY is an Active Matrix Electrophoretic Display (AMEPD) with interface and a reference system design. The 3.7'' active area contains 240×416 pixels, and has 2-bit B/W /R/Y 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

- 240*416 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
- 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. Application

Electronic Shelf Label System

4. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	3.7	Inch	
Display Resolution	240(H)×416(V)	Pixel	Dpi:129
Active Area	47.04(H)×81.54(V)	mm	
Pixel Pitch	0.202×0.203	mm	
Pixel Configuration	Rectangle		
Outline Dimension	53(H)×92.99 (V) ×0.90(D)	mm	**Without masking film**
Weight	8.5±0.5	g	

5. Mechanical Drawing of EPD module

2025/9/29

FRONT VIEW ①

TFT OD 92.99±0.1 ＊
PS 90.49±0.2
FPL 87.72±0.2
BORDER 82.54
TFT AA 81.54±0.1 ＊

0.70
2.10
2.98

TFT OD 53.00±0.1 ＊
PS 51.60±0.2
FPL 48.80±0.2
BORDER 48.04
TFT AA 47.04±0.1 ＊

0.70
2.10
2.98

4.15±0.3
PI Stiffener

易撕贴

White line

"A"

7.50±0.2

20.00±0.2 ③

DETAL "A"(1:1)

3.90
4.02
1.80
R1.00
8.25
5.36
2.68
R0.60

SIDE VIEW

FPC+PI 0.30±0.03 ⑤
0.10±0.03
Silicon-Glue
Edge Sealing
IC
PS 0.23(0.18+0.05)
FPL 0.17(0.13+0.2)
TFT(GLASS)0.50±0.05
Total 0.90±0.15(No protective film)＊ ①

BOTTOM VIEW

White line
14.00±0.1

0.50±0.10
0.35±0.03
0.50±0.03
11.50±0.05
12.50±0.10 ②

1.40±0.1 ⑥
3.00±0.2

NOTES:
1. GENERAL TOLERANCE:±0.2
2. ( ) REFERENCE DIMENSION
3. Important dimension: ①~⑦

Panel Size	3.7 inch EPD	
Resolution	416gate x 240source	
Display mode	Black&White&Red&Yellow	
Driving Voltage	VDD=3.0V	
Driver IC	JD79163	
Interface	SPI	
Operating temperature	0°C~40°C	
Storage temperature	0°C~40°C	

版本
(Version)

A0

Initial release

变更记录(Revise History)

设计(DESIGN)	Hst	
审核(CHECKED)	Hcr	
批准(APPROVED)	Aron	
客户承认 (CUSTOMER APPROVAL)		

日期(Date) 2025.09.22

TITLE: EPD
Drawing No. TSE037A56-BWRY

页面(Page) 1/1
单位(Unit) mm
比例(SCALE) 1：1
角度(Angle)

PIN	SIGNAL
1	NC
2	GDR
3	RESE
4	NC
5	VSH2
6	GND
7	GND
8	BS
9	BUSY_N
10	RST_N
11	DC
12	CSB
13	SCL
14	SDA
15	VDDIO
16	VDD
17	VCC
18	VSS
19	VMTP
20	VGHH
21	VSHH
22	VSL
23	VGL
24	VCOM

6. Input/output Terminals

Pin #	Single	Description	Remark
1	NC	No connection and do not connect with other NC pins	Keep Open
2	GDR	N-Channel MOSFET Gate Drive Control	
3	RESE	Current Sense Input for the Control Loop	
4	NC	No connection and do not connect with other NC pins	Keep Open
5	VDHR	Positive Source driving voltage	
6	GND		Note 6-6
7	GND		Note 6-6
8	BS	Bus selection pin	Note 6-5
9	BUSY_N	Busy state output pin	Note 6-4
10	RST_N	Reset	Note 6-3
11	DC	Data /Command control pin	Note 6-2
12	CSB	Chip Select input pin	Note 6-1
13	SCL	serial clock pin (SPI)	
14	SDA	serial data pin (SPI)	
15	VDDIO	Power for interface logic pins	
16	VDD	Power Supply pin for the chip	
17	GND	Ground	
18	VDDD	Core logic power pin	
19	VPP	Power Supply for OTP Programming	
20	VSH	Positive source driver Voltage	
21	VGH	Positive Gate driving voltage	
22	VSL	Negative Source driving voltage	
23	VGL	Negative Gate voltage.	
24	VCOM	VCOM driving voltage	

Note 6-1: This pin (CS#) is the chip select input connecting to the MCU. The chip

is enabled for MCU communication: only when CS# is pulled LOW.

Note 6-2: This pin (D/C#) 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.

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

Note 6-4: This pin (BUSY) is Busy state output pin. When Busy is Low ,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 Low when the driver IC is working such as:

- Outputting display waveform; or

- Communicating with digital temperature sensor

Note 6-5: This pin (BS1) 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.

Note 6-6: If customer don't want to use external temperature sensors,please make

TSCL and TSDA to

be ground ,not NC.

6.Note 6-6: We had made Pin 6 and Pin 7 on FPC to be ground.
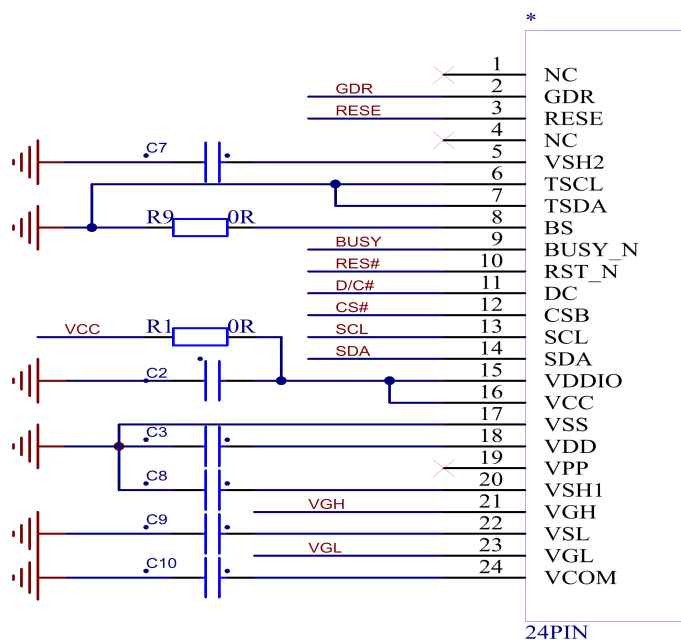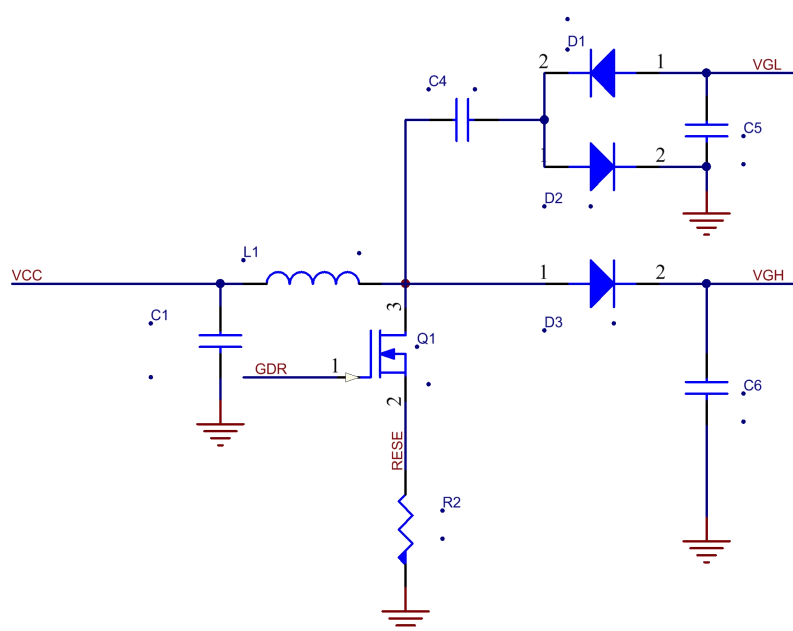
7. Reference Circuit

Figure. 9-1

Figure. 9-2

Part Name	Value	IST7163 /Reference Part
C1—C3	1uF	0603;X5RR;Voltage Rating: 25V
C4	4.7uF	0603;X5R;Voltage Rating: 25V
C5-C10	1uF	0603;X5R;Voltage Rating: 25V
D1—D3	**MBR0530**	MBR0530
		1) Reverse DC voltage≥30V
		2) Forward current≥500Ma
		3)Forward voltage≤430Mv
R2	0.47ohm	0.47 Ω/1% variation, ≥ 0.05W
Q1	MOS	NMOS:Si1308EDL
		1） Drain-Source breakdown voltage ≥30V
		2） Vgs（th）=0.9（Typ），1.3V（Max）
		3） Rds on≤ 2.1Ω @ Vgs=2.5V
L1	10uH	10uH/NRH3010T100MN
		DCR< 0.5 ohm, Isat ≥ 1.2A @ 25∘C

8. Absolute Maximum Rating

Symbol	Parameter	Rating	Unit	Humidity	Unit	Note
V$_{DD}$	Logic supply voltage	-0.3 to +6.0	V	-	-	
T$_{OPR}$	Operation temperature range	0 to 40	°C	45 to70	%	
Tttg	Transportation temperature range	-25 to 60	°C	45 to70	-	Note11-2
Tstg	Storage condition	0 to 40	°C	45 to70	%	Maximum storage time: 5 years

Note 11-1:We guarantee the single pixel display quality for 0-35℃, but we only guarantee the barcode readable for 35-40℃.Normal use is recommended to refresh every 24 hours.

Note11-2:Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the Electrical Characteristics chapter.

Note11-3: Tttg is the transportation condition, the transport time is within 10 days for -25℃~0℃ or 50℃~60℃

Note 11-4：When the four-color product is stored. The display screen should be kept white and face up.We suggest that the full black and full white picture could be added to clear the screen after the module is refreshed for a long time, the display effect would be better.

Note 11-5：Due to the nature of FPL, we will not control the display effect of yellow and white characters on white and yellow characters on white.

9. DC Characteristics

The following specifications apply for: VSS=0V, VDD=3.0V, TOPR=25℃

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
VDD	VDD operation voltage	-	2.4	3.0	3.6	V
VIH	High level input voltage	-	0.7xVIO	-	VIO	V
VIL	Low level input voltage	-	GND	-	0.3xVDD	V
VOH	High level output voltage	IOH = 400μA	VIO-0.4	-	-	V
VOL	Low level output voltage	IOL = -400μA	GND	-	GND+0.4	V
Iupdate	Module operating current	-	-	3	-	mA
Isleep	Deep sleep mode	VCI=3.3V	-	-	3	uA

- The Typical power consumption is measured using associated 25℃ waveform with followingpattern transition: from horizontal scan pattern to vertical scan pattern. (Note 12-)

- The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by TSD.

Note 12-1

The Typical power consumption

10. Power Consumption（Price tag screen）

Parameter	Symbol	Conditions	TYP	Max	Unit	Remark
Panel power consumption during update	-	25℃	-	200	mAs	-
Deep sleep mode	-	25℃	-	3	uA	-

mAs=update average current×update time

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 characteristics

T=25℃ ,VDD=3.3V

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX	UNIT	Note
R	Reflectance	White	30	35	-	%	Note 15-1
Gn	2Grey Level	-	-	KS+(WS-KS)×n(m-1)	-	L*	-
CR	Contrast Ratio	-	-	10	-	-	-
KS	Black State L* value	-	-	9	14	-	Note 15-1
	Black State a* value	-	-	≤8	-	-	Note 15-1
WS	White State L* value	-	60	65	-	-	Note 15-1
	White State b* value	-	-	-	≤2	-	Note 15-1
RS	Red State L* value	Red	23	26	28		Note 15-1
	Red State a* value	Red	35	-	40		Note 15-1
YS	Yellow State L* value	Yellow	56	58	62		Note 15-1
	Yellow State b* value	Yellow	56	61	65		Note 15-1
Panel	Image Update	Storage and transportation	-	Update the white screen	-	-	-
	Update Time	Operation	-	Suggest Updated once a day	-	-	-

WS : White state, KS : Black State,

Note 15-1 : Luminance meter : i - One Pro Spectrophotometer

11.2 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)：

$$CR = Rl/Rd$$
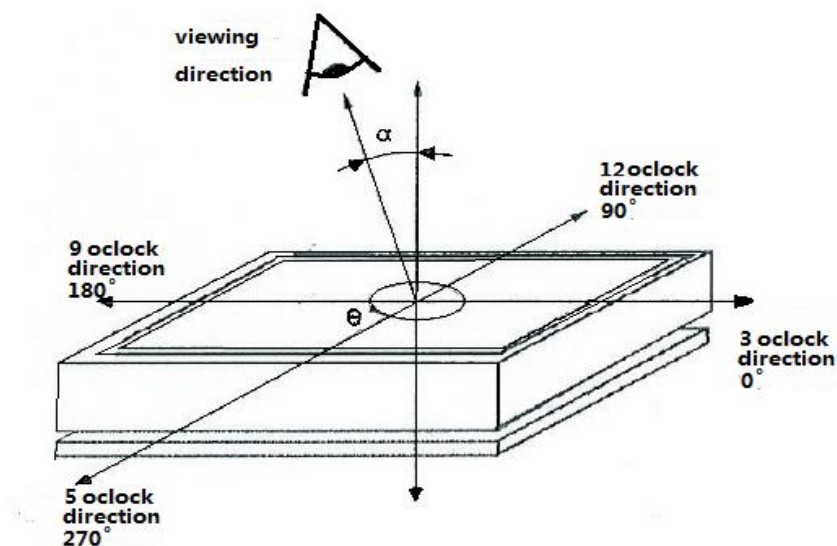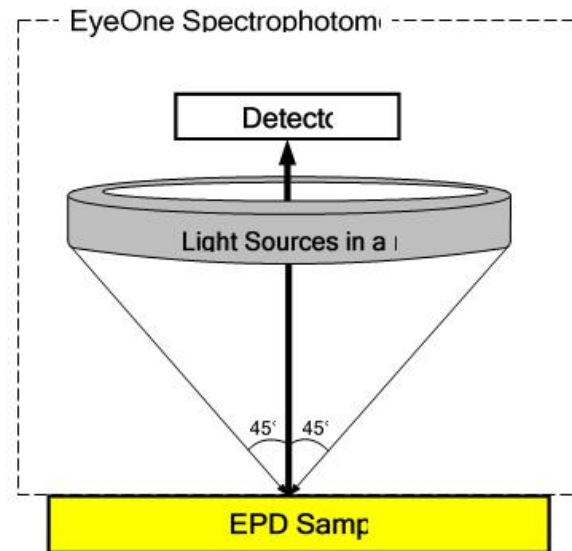
11.4 Reflection Ratio

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 there is dust on the surface, gently wipe it with absorbent cotton or a dust-free cloth. It is recommended to use anhydrous ethanol to clean the adhesive used to attach 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	REMARK
1	High-Temperature Operation	T=40℃，RH=35%RH，For 240Hrs	
2	Low-Temperature Operation	T = 0℃ for 240 hrs	
3	High-Temperature Storage	T=50℃ RH=35%RH For 240Hrs	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 168Hrs	
6	High Temperature, High-Humidity Storage	T=50℃，RH=90%RH，For 240Hrs	Test in white pattern
7	Temperature Cycle	-25℃(30min)~60℃(30min)，100 Cycle	Test in white pattern
8	Package Vibration	1.04G,Frequency : 20~200Hz Direction : X,Y,Z Duration: 30 minutes 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	Electrostatic Discharge(no-operation)	（Machine model）： +/-200v，0Ω,200PF	

Actual EMC level to be measured on customer application.

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

Note2：Operation is black/white pattern , hold time is 150S.

Note3：Keep testing after 2 hours placing at 20℃-25℃.

13.2 Product life time

The EPD Module is designed for a 3 -year life-time with 20 ℃/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 TSD and individual customers.
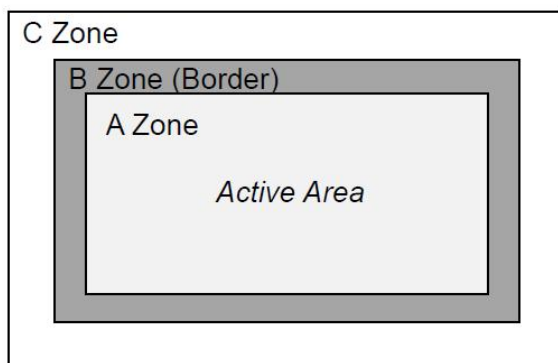
14. Block Diagram
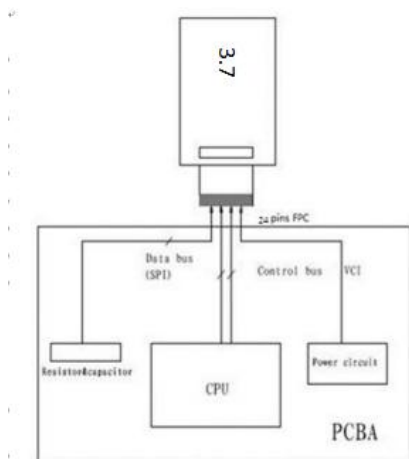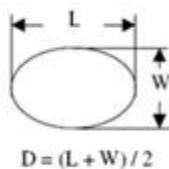

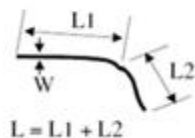## 15. Shipment inspection specification

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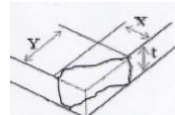
A Zone: Active Area
B Zone: Border Area
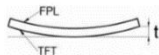C Zone: From B Zone edge to panel edge

15.2 Line/Spot defect size

15.3 Point and line standard

Shipment Inspection Standard						
Equipment：Electrical test fixture, Point gauge						
Outline dimension	53(H)×92.99 (V) ×0.95(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**
Spot	Electric Display	D≤0.25 ㎜	Ignore	Ignore
		0.25 ㎜＜D≤0.4 ㎜	N≤4	Ignore
		D＞0.4 ㎜	Not Allow	Ignore
Display malfunction	Electric Display	Not Allow	Not Allow	Ignore
Display error	Electric Display	Not Allow	Not Allow	Ignore
Scratch or line defect(include dirt)	Visual/Film card	L≤2 ㎜,W≤0.2 ㎜	Ignore	Ignore
		2.0mm＜L≤5.0mm,0.2＜W≤0.3mm,	N≤2	Ignore
		L＞5 ㎜,W＞0.3 ㎜	Not Allow	Ignore
PS Bubble	Visual/Film card	D≤0.2mm	Ignore	Ignore
		0.2mm≤D≤0.35mm	N≤4	Ignore
		D＞0.35 ㎜	Not Allow	Ignore
Corner /Edge chipping	Visual/Film card	X≤6mm,Y≤0.4mm, Do not affect the electrode circuit (Edge chipping) 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		
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

TBD

2025/9/29

16. Packing

TBD