Version: <u>1.0</u>

TECHNICAL SPECIFICATION

MODEL NO: 9.7inch e-Paper

The content of this information is subject to be changed without notice.

Waveshare Electronics

website: https://www.waveshare.com
Addr: 10F, International Science & Technology Building, Fuhong Rd, Futian District, Shenzhen, China

Revision History

Rev.	Issued Date	Revised Contents
1.0	2016-07-28	New

TECHNICAL SPECIFICATION

<u>CONTENTS</u>

1. General Description

    9.7inch e-Paper is a reflective electrophoretic technology display module based on active matrix TFT substrate. It has 9.7" active area with 1200 x 825 pixels, the display is capable to display images at 2-16 gray levels (1-4 bits) depending on the display controller and the associated waveform file it used.
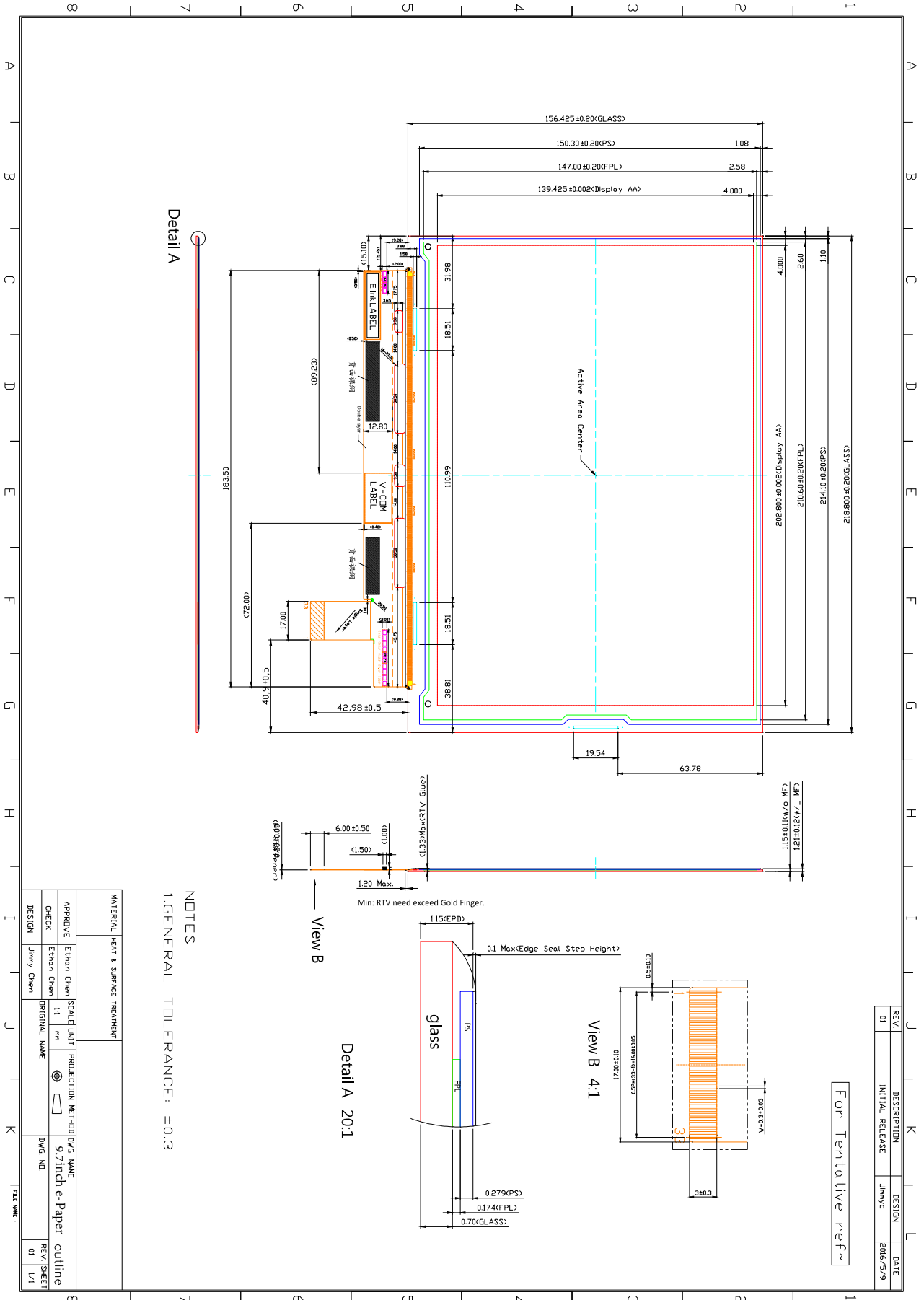
2. Features

➢ High contrast reflective/electrophoretic technology

➢ 1200x825 display

➢ High reflectance

➢ Ultra wide viewing angle

➢ Ultra low power consumption

➢ Pure reflective mode

➢ Bi-stable

➢ Commercial temperature range

➢ Landscape, portrait mode

➢ Antiglare hard-coated front-surface

3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	9.7	Inch	
Display Resolution	1200 (H)×825(V)	Pixel	
Active Area	202.8 (H)×139.425 (V)	mm	
Pixel Pitch	0.169 (H)x0.169 (V)	mm	
Pixel Configuration	Square		
Outline Dimension	218.8(W)×156.425(H)×1.15(D)	mm	
Module Weight	80 ± 8	g	
Number of Grey	16 Grey Level (monochrome)		
Display operating mode	Reflective mode		
Surface treatment	Anti-glare treatment		

4. Mechanical Drawing of EPD Module

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5. Input / Output Interface

5.1 Pin Assignment

IMSA-9637S-33Y905(IRISO)

Pin #	Signal	Description	Remark
1	VNEG	Negative power supply source driver	-15
2	NC	NO Connection	
3	VPOS	Positive power supply source driver	15
4	NC	NO Connection	
5	VSS	Ground	
6	NC	NO Connection	
7	VDD	Digital power supply drivers	3.3
8	XCL	Clock source driver	
9	XLE	Latch enable source driver	
10	XOE	Output enable source driver	
11	VDD	Digital power supply drivers	3.3
12	XSTL	Start pulse source driver	
13	D0	Data signal source driver	
14	D1	Data signal source driver	
15	D2	Data signal source driver	
16	D3	Data signal source driver	
17	D4	Data signal source driver	
18	D5	Data signal source driver	
19	D6	Data signal source driver	
20	D7	Data signal source driver	
21	NC	NO Connection	
22	VCOM	Common voltage	
23	NC	NO Connection	
24	VGH	Positive power supply gate driver	27
25	NC	NO Connection	
26	VGL	Negative power supply gate driver	-20
27	NC	NO Connection	
28	MODE1	Output mode selection gate driver	
29	MODE1	Output mode selection gate driver	
30	VDD	Digital power supply drivers	3.3
31	SPV	Start pulse gate driver	
32	CKV	Clock gate driver	
33	Border	Border connection	

5.2 Panel Scan Direction
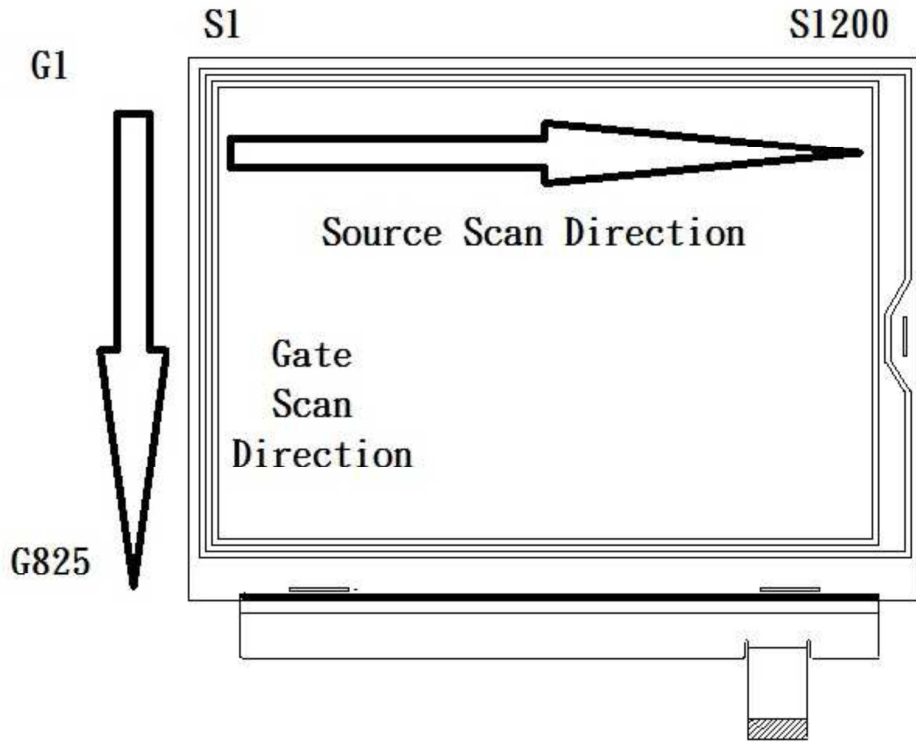
6. Display Module Electrical Characteristics

6.1 Absolute Maximum Rating

Parameter	Symbol	Rating	Unit	Remark
Logic Supply Voltage	V_{DD}	-0.3 to +7	V	
Positive Supply Voltage	V_{POS}	-0.3 to +18	V	
Negative Supply Voltage	V_{NEG}	+0.3 to -18	V	
Max .Drive Voltage Range	V_{POS} - V_{NEG}	36	V	
Supply Voltage	V_{GH}	-0.3 to +45	V	
Supply Voltage	V_{GL}	-25.0 to +0.3	V	
Supply Range	V_{GH}-V_{GL}	-0.3 to +55	V	
Operating Temp. Range	T_{OTR}	0 to +50	℃	
Storage Temperature	T_{STG}	-25 to +70	℃	

6.2 Display Module DC Characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Signal Ground	V_{SS}		-	0	-	V
Logic Voltage Supply	V_{DD}		3.0	3.3	3.6	V
	I_{DD}	V_{DD}=3.3V	-	2.7	4.2	mA
Gate Negative Supply	V_{GL}		-21	-20	-19	V
	I_{GL}	V_{GL}=-20V	-	1.2	6.6	mA
Gate Positive supply	V_{GH}		26	27	28	V
	I_{GH}	V_{GH}=27V	-	1.2	6.6	mA
Source Negative Supply	V_{NEG}		-15.4	-15	-14.6	V
	I_{NEG}	V_{NEG}=-15V	-	4.4	88.9	mA
Source Positive Supply	V_{POS}		14.6	15	15.4	V
	I_{POS}	V_{POS}=15V	-	4.4	147.9	mA
Border Supply	V_{COM}		-4	Adjusted	-0.3	V
Asymmetry Source	V_{ASM}	V_{POS}+V_{NEG}	-800	0	800	mV
Common Voltage	V_{COM}		-4	Adjusted	-0.3	V
	I_{COM}		-	0.43	-	mA
Power Panel	P		-	-	3980	mW
Standby Power Panel	P_{STBY}		-	-	0.6	mW

- The maximum power consumption is measured using 85Hz waveform with following pattern transition: from pattern of repeated 1 consecutive black scan lines followed by 1 consecutive white scan line to that of repeated 1 consecutive white scan lines followed by 1 consecutive black scan lines (Note 6-1).

- The Typical power consumption is measured using 85Hz waveform with following pattern transition: from horizontal 4 grey scale pattern to vertical 4 grey scale patterns (Note 6-2).

- The standby power is the consumed power when the panel controller is in standby mode.

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

- V_{COM} is recommended to be set in the range of assigned value $\pm$ 0.1V

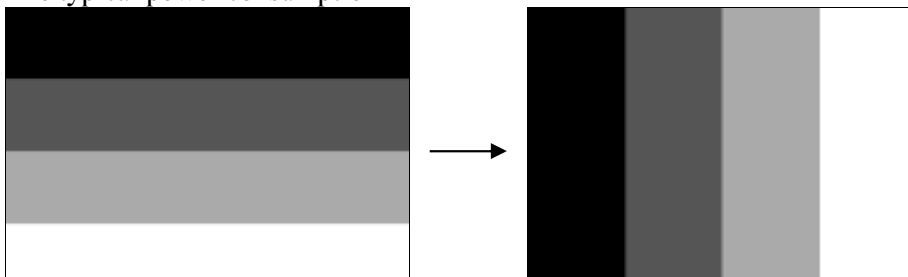- The maximum I_{COM} inrush current is about 1.64 mA

Note6-1
The maximum power consumption
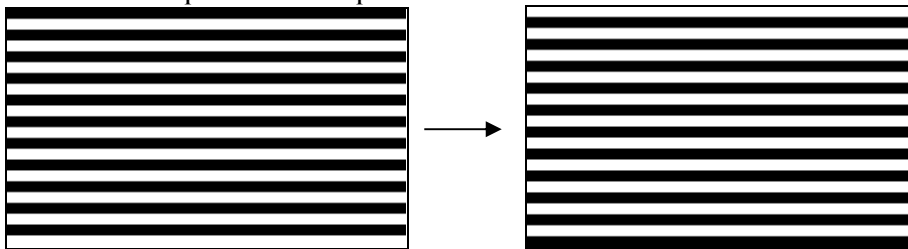
Note6-2
The typical power consumption

6.3 Display Module AC characteristics

| Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	fckv	-	-	200	kHz
Minimum "L" clock pulse width	twL	0.5	-	-	us
Minimum "H" clock pulse width	twH	0.5			us
Clock rise time	trckv	-	-	100	ns
Clock fall time	tfckv	-	-	100	ns
SPV setup time	tSU	100	-	-	ns
SPV hold time	tH	100	-	-	ns
Pulse rise time	trspv	-	-	100	ns
Pulse fall time	tfspv	-	-	100	ns
Clock XCL cycle time	tcy	16.7	20	-	ns
D0 .. D7 setup time	tsu	8	-	-	ns
D0 .. D7 hold time	th	8	-	-	ns
XSTL setup time	tstls	8	-	-	ns
XSTL hold time	tstlh	8	-	-	ns
XLE on delay time	tLEdly	40	-	-	ns
XLE high-level pulse width (When VDD=1.7V to 2.1V)	tLEw	40	-	-	ns
XLE off delay time	tLEoff	200	-	-	ns
Output setting time to +/- 30Mv (Cload=200pF)	tout	-	-	12	us

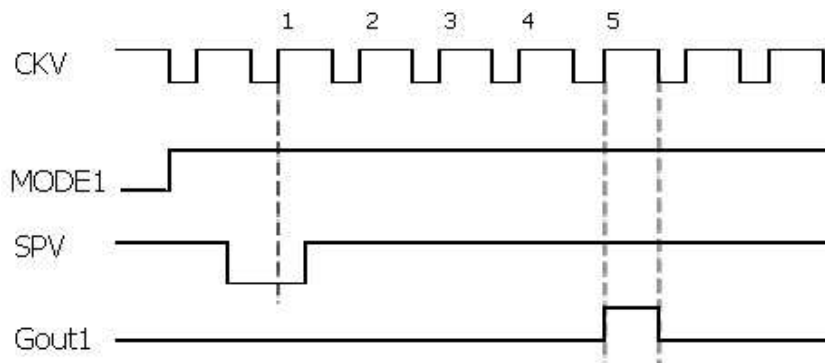OUTPUT LATCH CONTROL SIGNALS
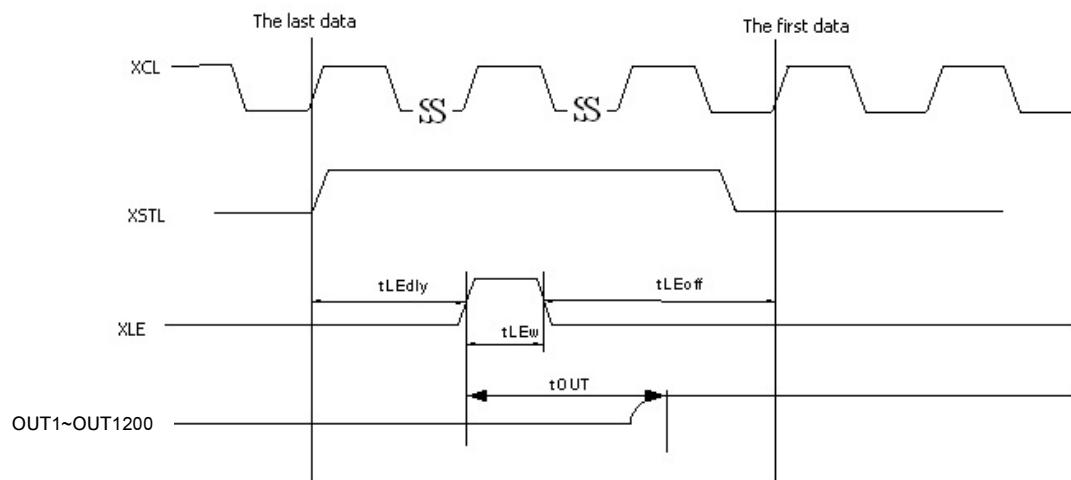
CLOCK & DATA TIMING
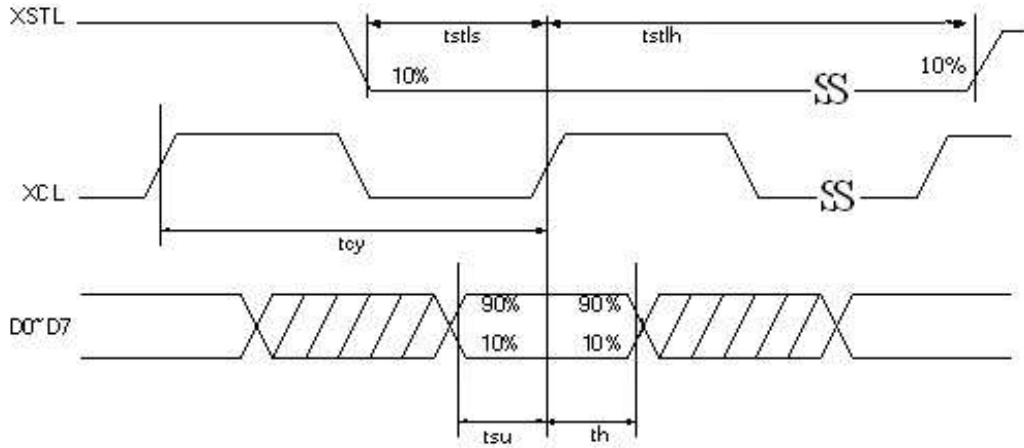
CKV & SPV TIMING
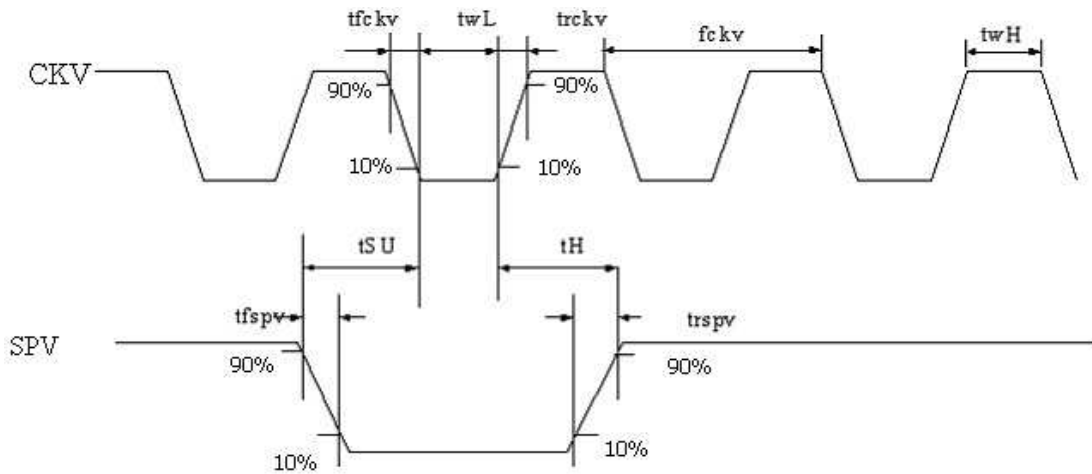
GATE OUTPUT TIMING

Note：First gate line on timing

After 5CKV, gate line is on.

6.4 Refresh Rate

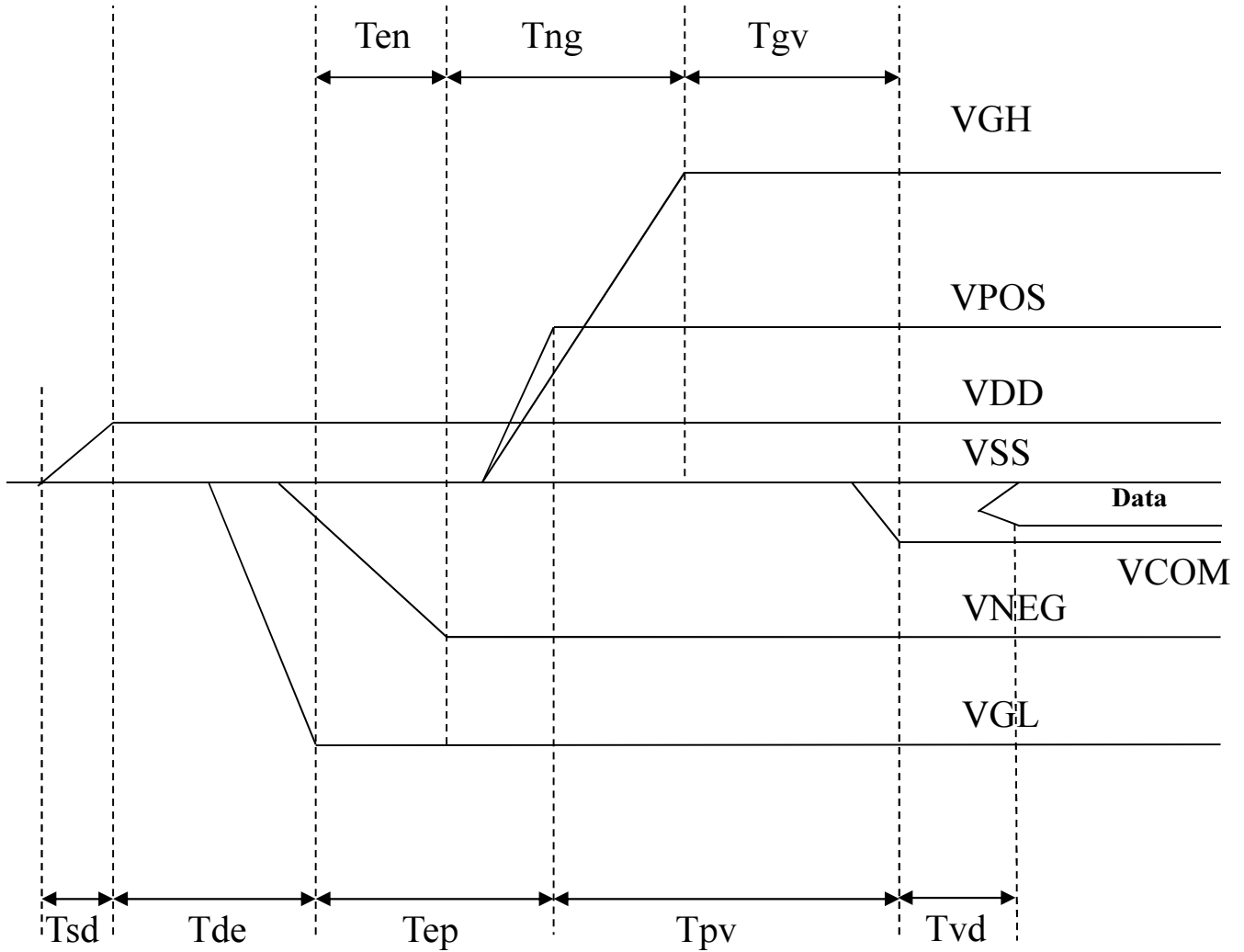The module is applied at a maximum screen refresh rate of 85Hz.

	Min.	**Max.**
Refresh Rate	-	85Hz

7. Power Sequence

Power rails must be sequenced in the following order：

1. VSS → VDD → VNEG → VPOS (Source driver) → VCOM

2. VSS → VDD → VGL → VGH (Gate driver)

POWER ON

	Min.	Max.
Tsd	30us	-
Tde	100us	-
Tep	1000us	-
Tpv	100us	-
Tvd	100us	-
Ten	0us	-
Tng	1000us	-
Tgv	100us	-

POWER OFF
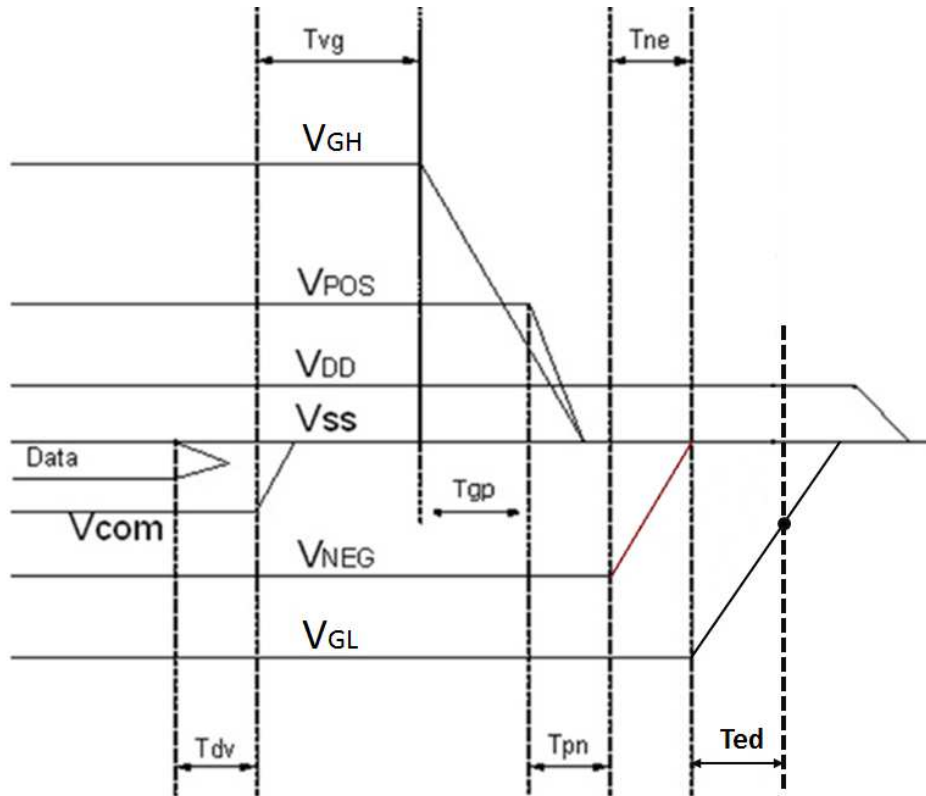
	Min.	**Max.**	**Remark**
Tdv	100μs	-	-
Tvg	0μs	-	-
Tgp	0μs	-	-
Tpn	0μs	-	-
Tne	0μs	-	-
Ted	0.5s	-	Discharged point @ -7.4 Volt

Note 7-1: Supply voltages decay through pull-down resistors.

Note 7-2: Begin to turn off VGL power after VNEG and VPOS are completely or almost discharged to GND state.

Note 7-3: VGL must remain negative of VCOM during decay period.

8. Optical Characteristics

8.1 Specifications

Measurements are made with that the illumination is under an angle of 45 degrees, the detector is perpendicular unless otherwise specified.

T = 25°C

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit	Note
R	Reflectance	White	33	42	-	%	Note 8-1
Gn	N$_{th}$ Grey Level	-		DS+(WS-DS)× n/(m-1)		L*	-
CR	Contrast Ratio	-	10	16	-		-

WS: White state , DS: Dark state, Gray state from Dark to White :DS、G1、G2…、Gn…、Gm-2、WS

m:4、8、16　when 2、3、4 bits mode

Note 8-1: Luminance meter: Eye – One Pro Spectrophotometer

8.2 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
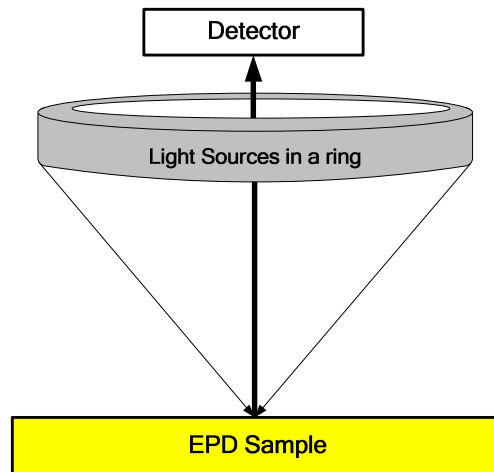
8.3 Reflection Ratio

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.

9. Handling, Safety and Environmental Requirements and Remark

Warning
The display glass may break when it is dropped or bumped on a hard surface. Handle with care. Should the display break, do not touch the electrophoretic material. In case of contact with electrophoretic material, 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.

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	This data sheet contains preliminary 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 at 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 does not form part of the specification.	

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.

10. Reliability Test

|	Test	Condition	Method
1	High-Temperature Operation	T = +50°C, RH = 30% for 240 hrs	IEC 60 068-2-2Bp
2	Low-Temperature Operation	T = 0°C for 240 hrs	IEC 60 068-2-2Ab
3	High-Temperature Storage	T = +70°C, RH=23% for 240 hrs (Test In White Pattern)	IEC 60 068-2-2Bp
4	Low-Temperature Storage	T = -25°C for 240 hrs (Test In White Pattern)	IEC 60 068-2-1Ab
5	High-Temperature, High-Humidity Operation	T = +40°C, RH = 90% for 168 hrs	IEC 60 068-2-3CA
6	High Temperature, High- Humidity Storage	T = +60℃, RH=80%　for 240hrs (Test In White Pattern)	IEC 60 068-2-3CA
7	Temperature Cycle	-25℃ → +70℃, 100 Cycles 30mins 30 mins (Test In White Pattern)	IEC 60 068-2-14
8	Solar Radiation Test	765 W/m^2 for 168hrs,40℃ (Test In White Pattern)	IEC60 068-2-5Sa
9	Package Vibration	1.04G, Frequency: 10~500Hz Direction: X,Y,Z Duration: 1 hours in each direction	Full packed for shipment
10	Package Drop Impact	Drop from height of 122 cm on concrete surface. Drop sequence: 1 corner, 3 edges, 6 faces One drop for each.	full packed for shipment
11	Electrostatic Effect (non-operating)	(Machine model)+/- 250V 0Ω, 200pF	IEC 62179, IEC 62180
12	Stylus Tapping	POLYACETAL Pen: Top R:0.8 mm Load: 300gf Speed: 2 times/sec Total 13,500times,	Test with bezel and device to simulate full product test

Actual EMC level to be measured on customer application.

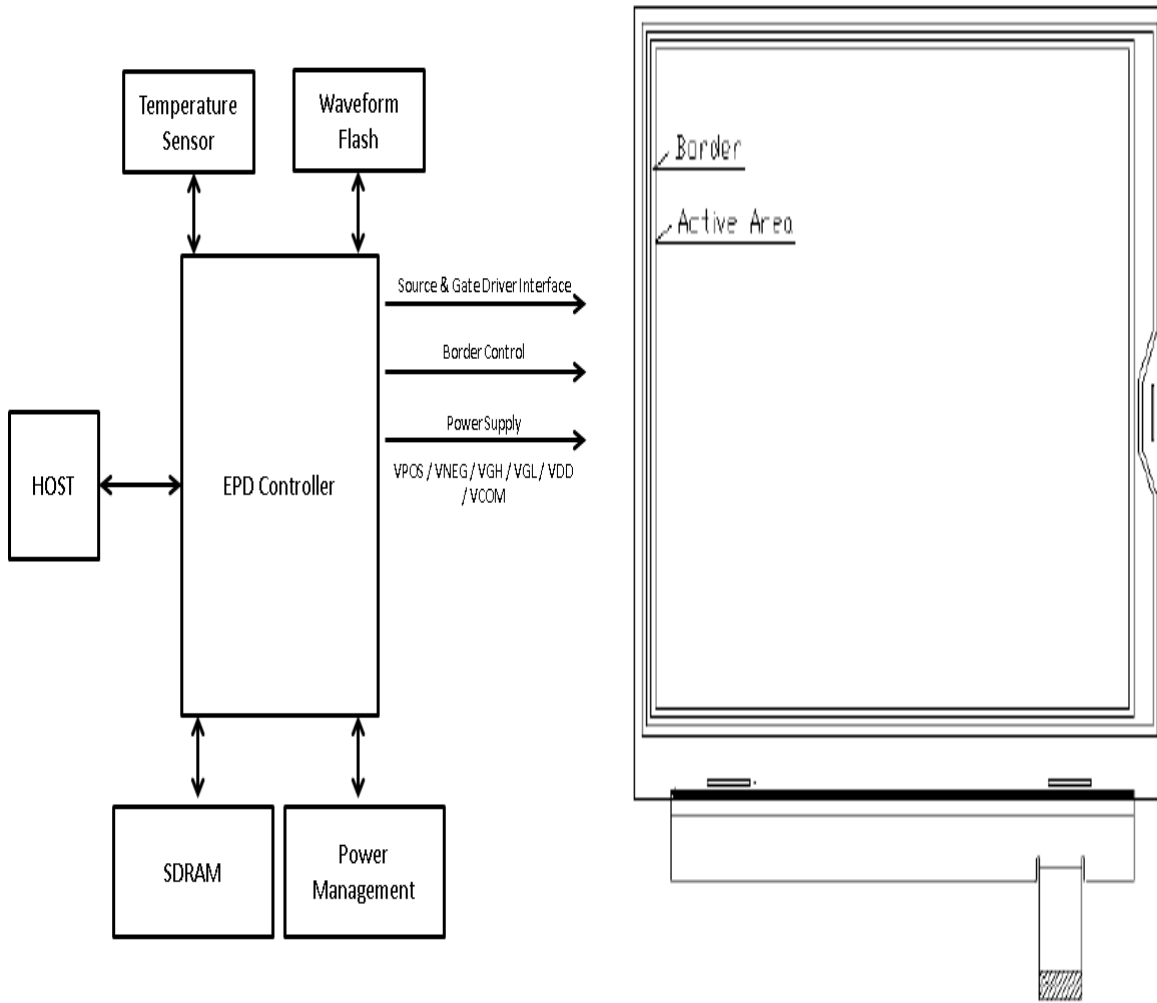Note：The protective film must be removed before temperature test.

[Criteria]

In the standard conditions, there is not display function NG issue occurred (Including: line defect, no image).

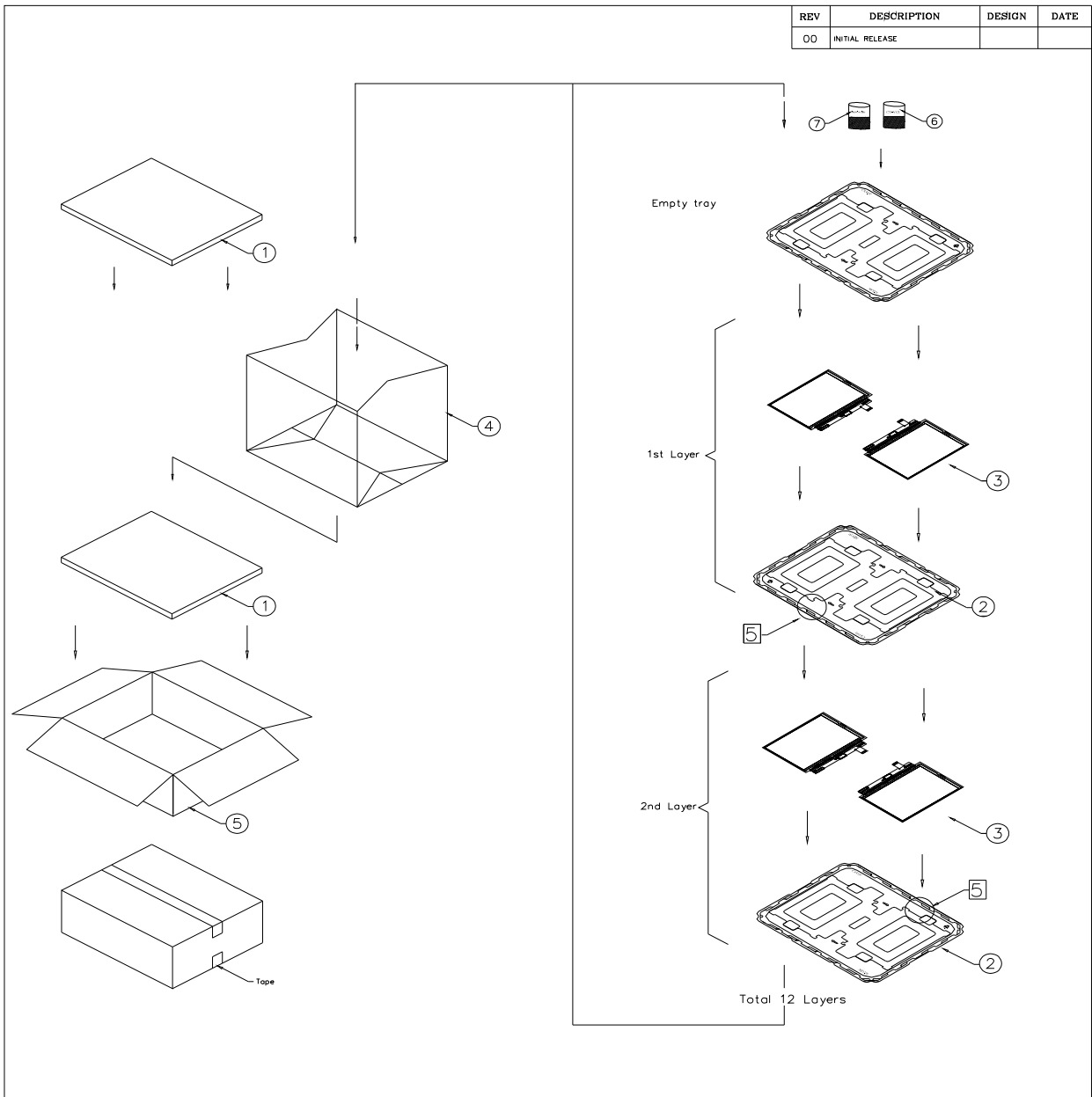All the cosmetic specification is judged before the reliability stress.

11. Border Definition
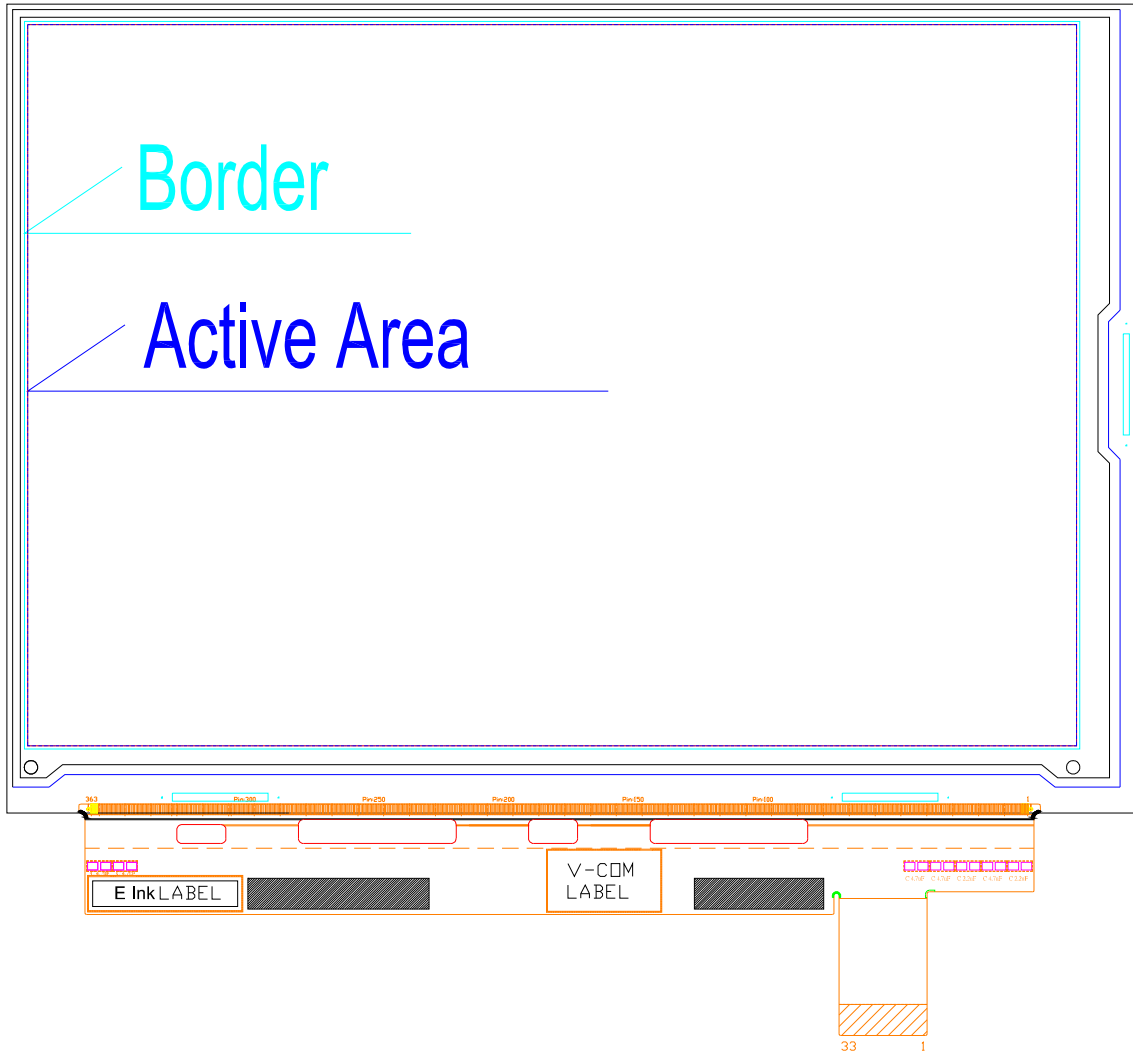
12. Block Diagram

13. Packing

	REV	DESCRIPTION	DESIGN	DATE
	00	INITIAL RELEASE		

Empty tray

1st Layer

2nd Layer

Total 12 Layers

Tape

NOTE:
1. One layer include:
   2 pcs module & 1 piece of tray.
2. Q'TY: 24 pcs panel/carton.
3. Dimension: 445*365*170mm
4. Make sure tray stacked with 180° rotation.
   We can check this by lateral side view.

8	EASY TAPE	24	For Remove Protect Sheet
7	30g加厚複合紙邊磺乾燥劑73*95mm	2	
6	防鏽劑(保護容積25L)	3	
5	CARTON INTERNAL	1	
4	擋口袋450*380*580mm	1	抗靜電
3	9.7inch e-Paper	24	
2	TRAY	13	抗靜電
1	EPE FOAM	2	
ITEM	DESCRIPTION	QTY	REMARK

MTL.SPEC.	UNSPECIFIED TOL'S ±5.0mm		REMARK				
	ANGLE						
	ROUGHNESS						
APPROVE		SCALE 1:1	UNIT mm	SHEET 1 OF 1	DWG.TITLE		
CHECK						PACKING Dim	
DESIGN		MTL.NO.			DWG.NO.		REV. 01	A4 SIZE