

Version: 0.7

**TECHNICAL SPECIFICATION**

**MODEL NO: ED052TC2**

The content of this information is subject to be changed without notice.  
Please contact E Ink or its agent for further information.

☐ Customer's Confirmation

Customer \_\_\_\_\_

Date \_\_\_\_\_

By \_\_\_\_\_

☐ E Ink's Confirmation

Approved By \_\_\_\_\_

Confirmed By \_\_\_\_\_

Prepared By \_\_\_\_\_

## Revision History

Rev.	Issued Date	Revised Contents
0.7	May ,17,2016	New
0.8	Aug ,22,2016	Update drawing

# ***TECHNICAL SPECIFICATION***

## **CONTENTS**

<b><i>NO.</i></b>	<b><i>ITEM</i></b>	<b><i>PAGE</i></b>
-	Cover	1
-	Revision History	2
-	Contents	3
1	General Description	4
2	Features	4
3	Mechanical Specifications	4
4	Mechanical Drawing of Display module	5
5	Input/Output Interface	6
6	Display Module Electrical Characteristics	8
7	Power Sequence	13
8	Optical Characteristics	15
9	Handling, Safety and Environment Requirements And Remark	16
10	Reliability test	18
11	Border definition	19
12	Packing	20

## 1. General Description

ED052TC2 is a reflective electrophoretic E Ink<sup>®</sup> technology display module based on active matrix TFT substrate. It has 5.17" active area with 540 x 960 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.

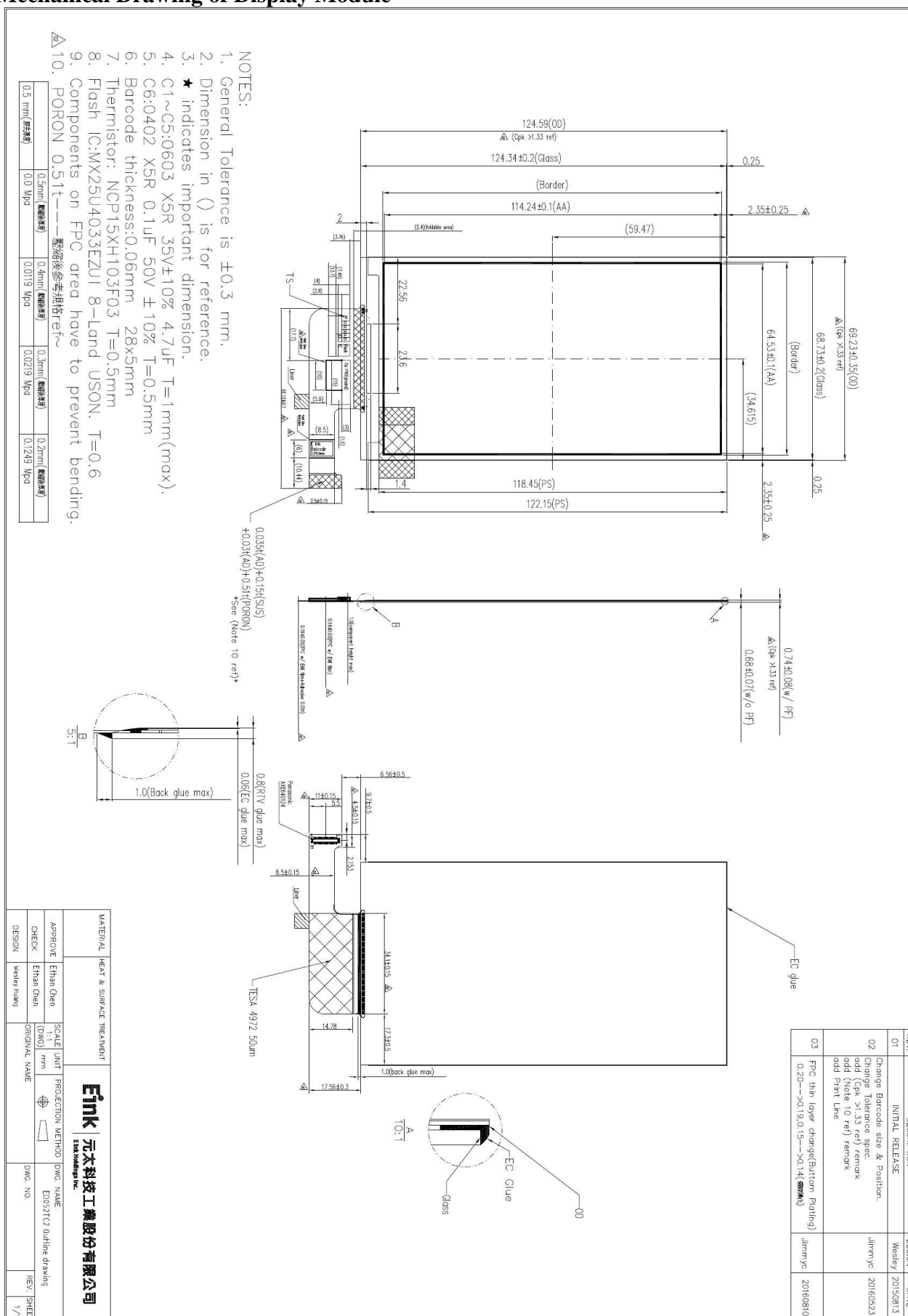
## 2. Features

- Carta High contrast reflective/electrophoretic technology
- 540 x 960 display
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable
- Commercial temperature range
- Portrait mode

## 3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	5.17	Inch	
Display Resolution	540 (H)×960(V)	Pixel	
Active Area	64.53 (H)×114.24 (V)	mm	
Pixel Pitch	119.5 (H) × 119 (V)	μm	
Pixel Configuration	Rectangle		
Outline Dimension	69.23 (W) × 124.59 (H) × 0.68 (D)	mm	
Module Weight	11.3 ±1.2	g	
Number of Gray	16 Gray Level (monochrome)		
Display operating mode	Reflective mode		

#### 4. Mechanical Drawing of Display Module



## 5. Input/Output Interface

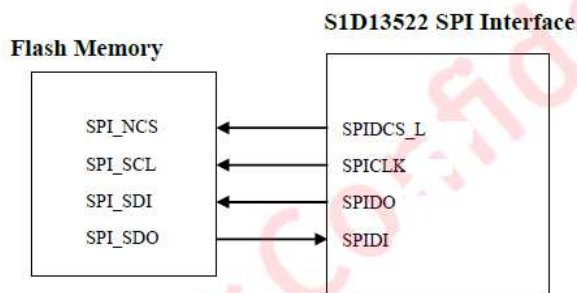
### 5-1) Pin Assignment

Connector type : Panasonic AXE640124

Pin	Symbol	Description	Remark
1	VNEG	Negative power supply source driver	
2	VPOS	Positive power supply source driver	
3	VNEG	Negative power supply source driver	
4	VPOS	Positive power supply source driver	
5	VSS	Ground	
6	VSS	Ground	
7	VDD	Digital power supply drivers (3.3V)	
8	XON		Note 5-2
9	VDD	Digital power supply drivers (3.3V)	
10	VSS	Ground	
11	TS1	Thermistor sensor pin 1	
12	XOE	Output enable source driver	
13	XCL	Clock source driver	
14	XSTL	Start pulse source driver	
15	XLE	Latch enable source driver	
16	VSS	Ground	
17	D0	Data signal source driver	
18	D1	Data signal source driver	
19	D2	Data signal source driver	
20	D3	Data signal source driver	
21	D4	Data signal source driver	
22	D5	Data signal source driver	
23	D6	Data signal source driver	
24	D7	Data signal source driver	
25	CKV	Clock gate driver	
26	SPV	Start pulse gate driver	
27	MODE	Output mode selection gate driver	
28	VSS	Ground	
29	VCOM	Common connection	
30	BORDER	Border connection	
31	VSS	Ground	
32	VDD2	SPI flash power supply (1.8V)	
33	SPI_SCL	Serial Data Clock for Flash memory	Note 5-1
34	SPI_NCS	Chip Select for Flash memory	Note 5-1

35	SPI_SDI	Serial Data Input for Flash memory	Note 5-1
36	SPI_SDO	Serial Data Output for Flash memory	Note 5-1
37	VSS	Ground	
38	AGND	Thermistor Analog Ground	
39	VGH	Positive power supply gate driver	
40	VGL	Negative power supply gate driver	

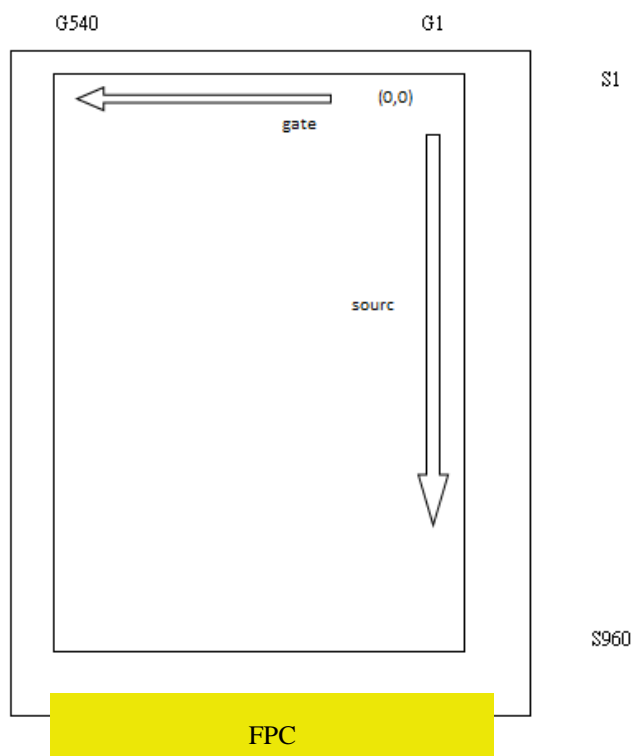
#### Note 5-1



#### Note 5-2

In order to the flexibility for implement the dRegal waveform in the future, the additional GPIO from EPSON TCON is necessary to be reserved to connect the Xon pin.  
If not implement dRegal waveform, please connect to VDD voltage

#### 5-2) Panel Scan direction



## 6. Display Module Electrical Characteristics

### 6-1) Absolute Maximum Ratings:

Parameter	Symbol	Rating	Unit	Remark
Logic Supply Voltage	VDD	-0.3 to +5	V	--
Positive Supply Voltage	V <sub>POS</sub>	-0.3 to +18	V	--
Negative Supply Voltage	V <sub>NEG</sub>	+0.3 to -18	V	--
Max .Drive Voltage Range	V <sub>POS</sub> - V <sub>NEG</sub>	36	V	--
Supply Voltage	VGH	-0.3 to +46	V	--
Supply Voltage	VGL	-25.0 to +0.3	V	--
Supply Range	VGH-VGL	-0.3 to +46	V	--
Operating Temp. Range	TOTR	0 to +50	°C	--
Storage Temperature	TSTG	-25 to +70	°C	--



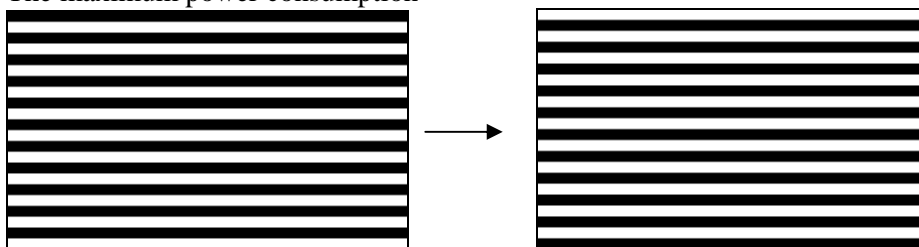
## 6-2) Display Module DC characteristics

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Signal ground	V <sub>SS</sub>		-	0	-	V
Logic Voltage supply	V <sub>DD</sub>		3.0	3.3	3.6	V
	I <sub>VDD</sub>	V <sub>DD</sub> =3.3V	-	0.72	2.1	mA
Gate Negative supply	V <sub>GL</sub>		-21	-20	-19	V
	I <sub>GL</sub>	V <sub>GL</sub> = -20V	-	0.6	3.8	mA
Gate Positive supply	V <sub>GH</sub>		21	22	23	V
	I <sub>GH</sub>	V <sub>GH</sub> = 22V	-	0.58	1.6	mA
Source Negative supply	V <sub>NEG</sub>		-15.4	-15	-14.6	V
	I <sub>NEG</sub>	V <sub>NEG</sub> = -15V	-	0.58	24.2	mA
Source Positive supply	V <sub>POS</sub>		14.6	15	15.4	V
	I <sub>POS</sub>	V <sub>POS</sub> = 15V	-	0.63	26.9	mA
Border supply	V <sub>COM</sub>		-2.54	Adjusted	-2.94	v
Asymmetry source	V <sub>Asym</sub>	V <sub>POS</sub> +V <sub>NEG</sub>	-800	0	800	mV
Common voltage	V <sub>COM</sub>		-2.54	Adjusted	-2.94	V
	I <sub>COM</sub>		-	0.1	-	mA
Panel Power	P		-	46	890	mW
Standby power panel	P <sub>STBY</sub>		-	-	0.25	mW
Operating temperature			0	-	50	°C
Storage temperature			-25	-	70	°C

- 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 gray scale pattern to vertical 4 gray scale pattern. (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 E Ink.
- Vcom is recommended to be set in the range of assigned value  $\pm 0.1V$ .
- The maximum  $I_{COM}$  inrush current is about 600 mA

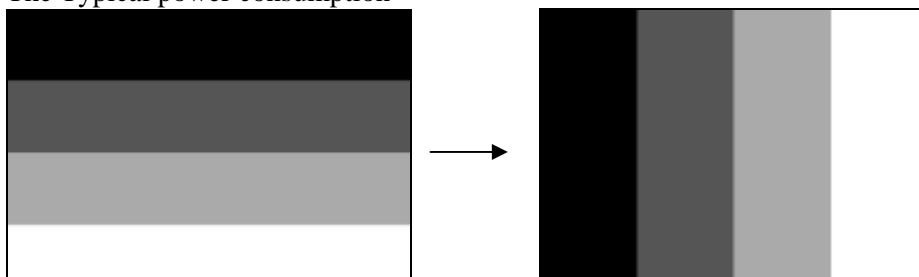
Note 6-1

The maximum power consumption



Note 6-2

The Typical power consumption



### 6-3) Refresh Rate

The module ED052TC2 is applied at a maximum screen refresh rate of 85Hz.

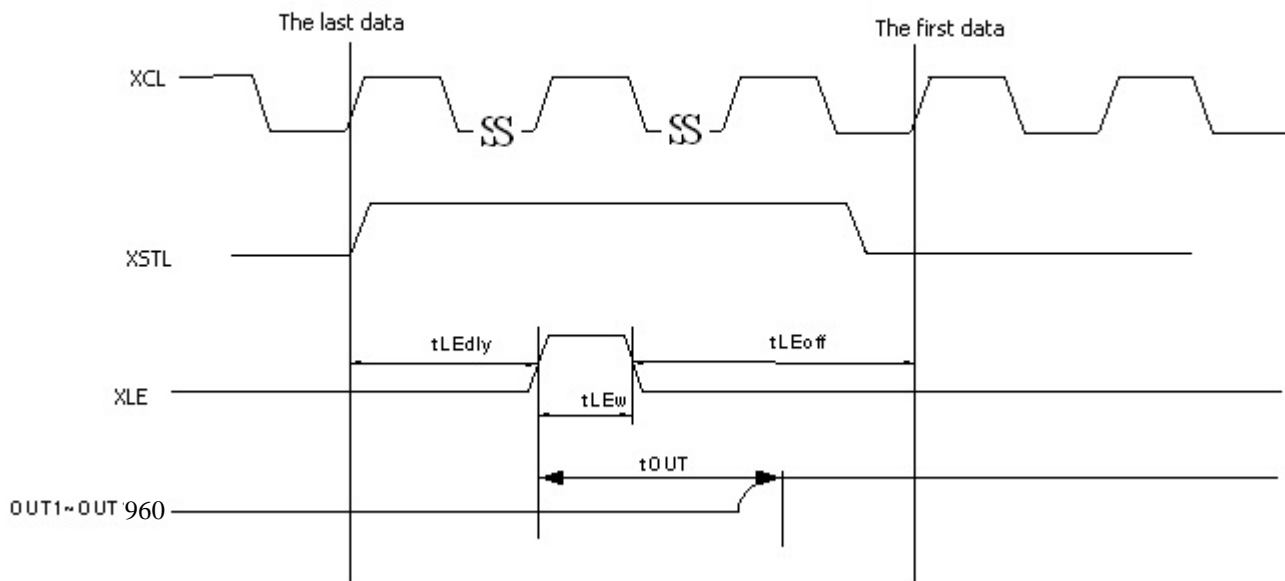
	Min	Max
<b>Refresh Rate</b>	-	85Hz

#### 6-4) Display Module AC characteristics

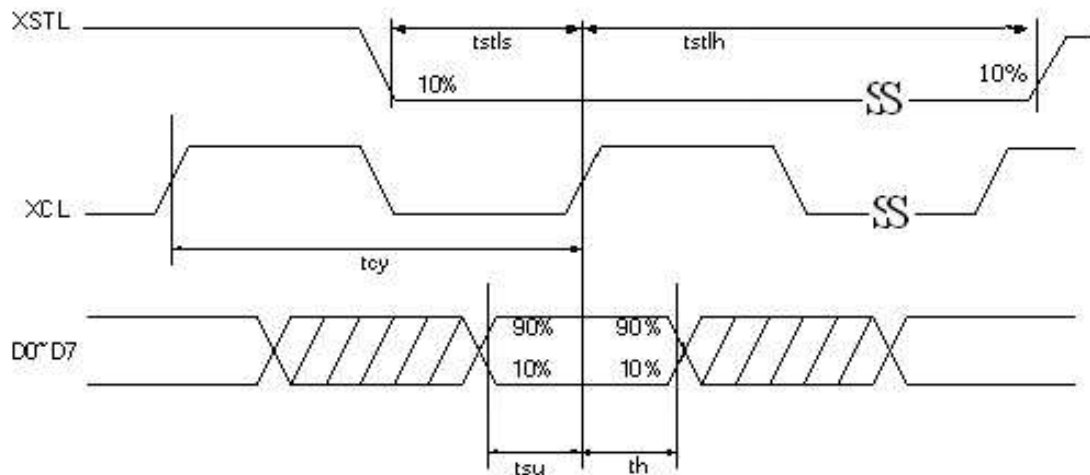
VDD=3.0V to 3.6V, unless otherwise specified.

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	-	twH-100	ns
SPV hold time	tH	100	-	twH-100	ns
Pulse rise time	trspv	-	-	100	ns
Pulse fall time	tfspv	-	-	100	ns
Clock XCL cycle time	tcy	16.67	50	-	ns
D0 .. D7 setup time	tsu	8	-	-	ns
D0 .. D7 hold time	th	8	-	-	ns
XSTL setup time	tstls	0.5*tcy	-	0.8*tcy	ns
XSTL hold time	tstlh	0.5*tcy	-	240*tcy-tstls	ns
XLE on delay time	tLEdly	3.5*tcy	-	-	ns
XLE high-level pulse width (When VCC=3.0V to 3.6V)	tLEw	300	-	-	ns
XLE off delay time	tLEoff	200	-	-	ns
Output setting time to +/- 30mV(C <sub>load</sub> =200pF)	tout	-	-	20	us

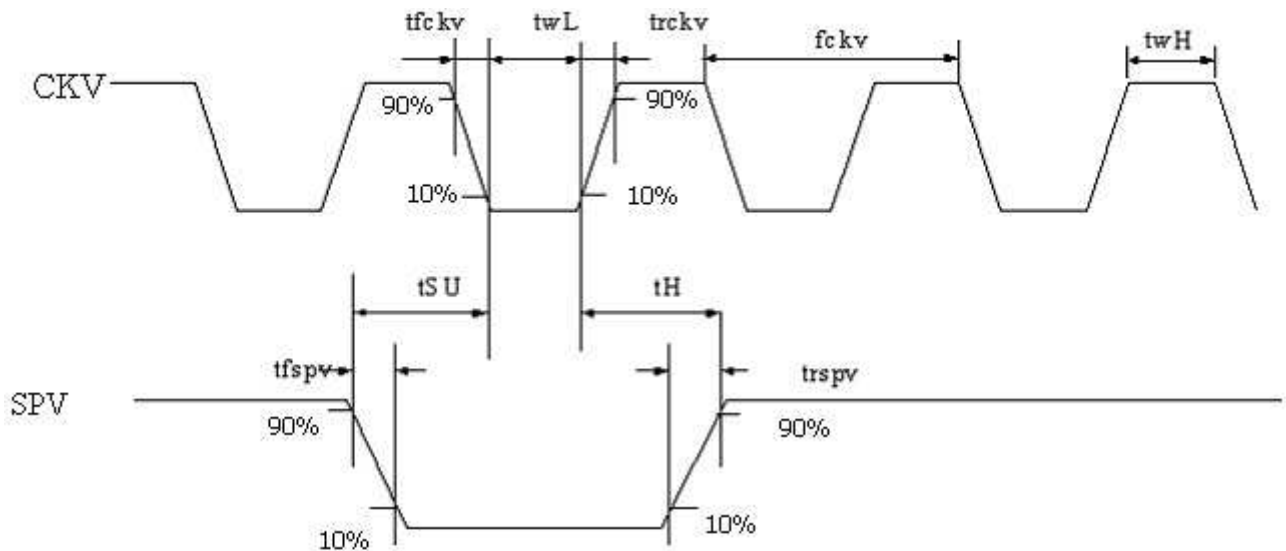
#### OUTPUT LATCH CONTROL SIGNALS



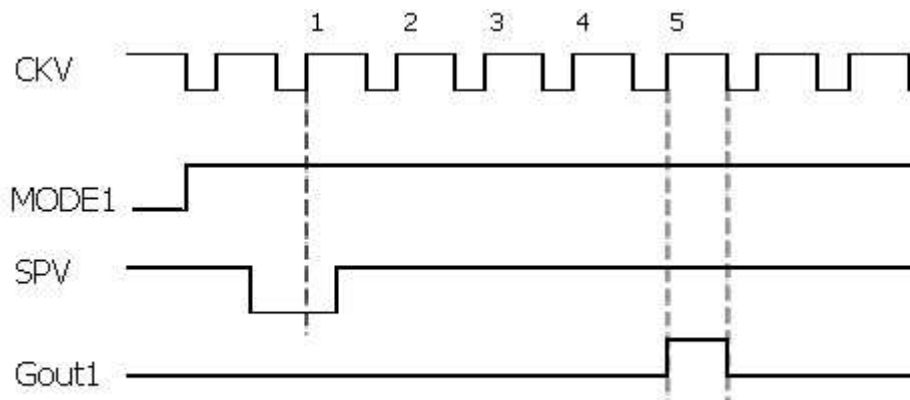
### CLOCK & DATA TIMING



### CKV & SPV TIMING



### GATE OUTPUT TIMING



Note : First gate line on timing

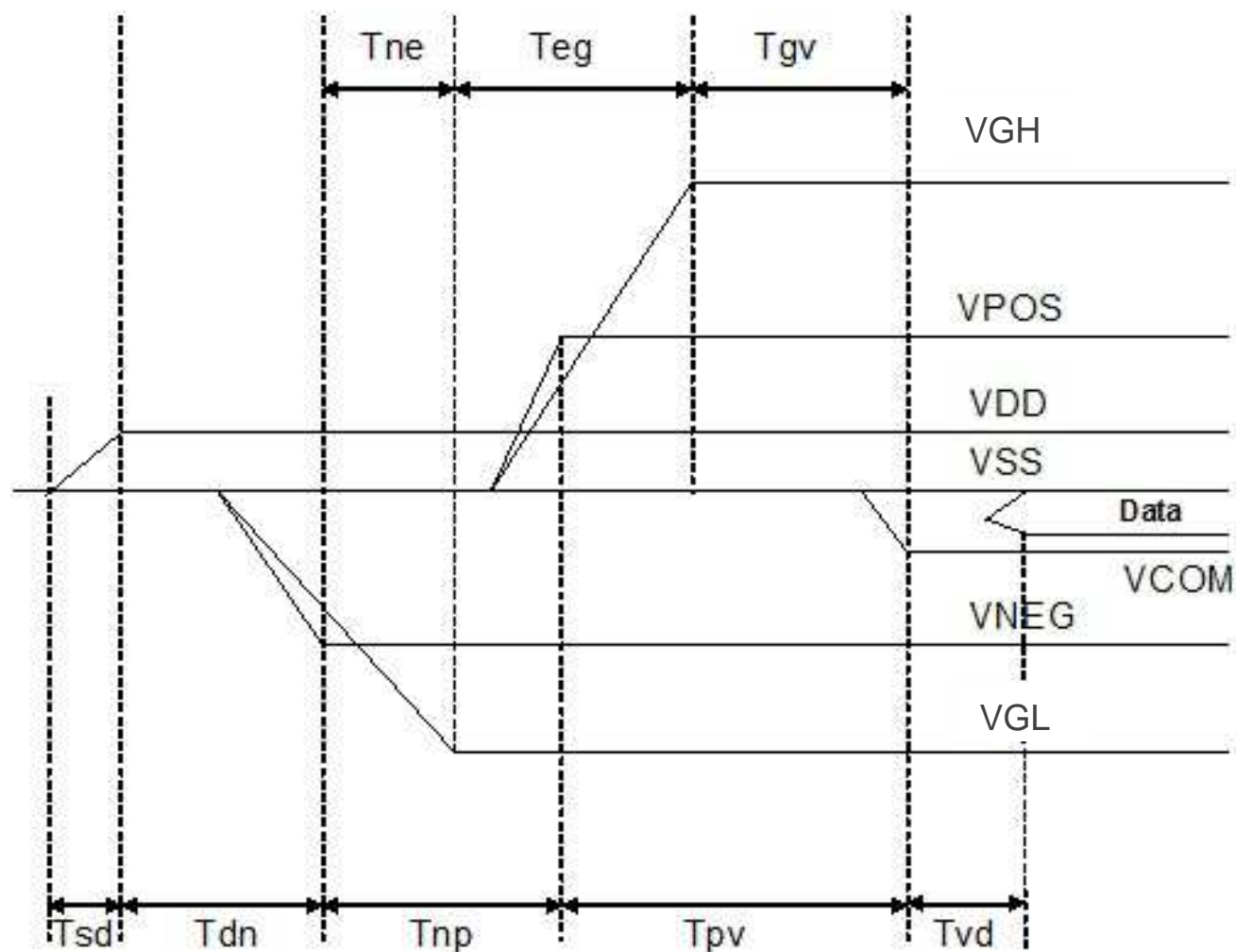
After 5CKV , gate line is on .

## 7. Power Sequence

Power Rails must be sequenced in the following order :

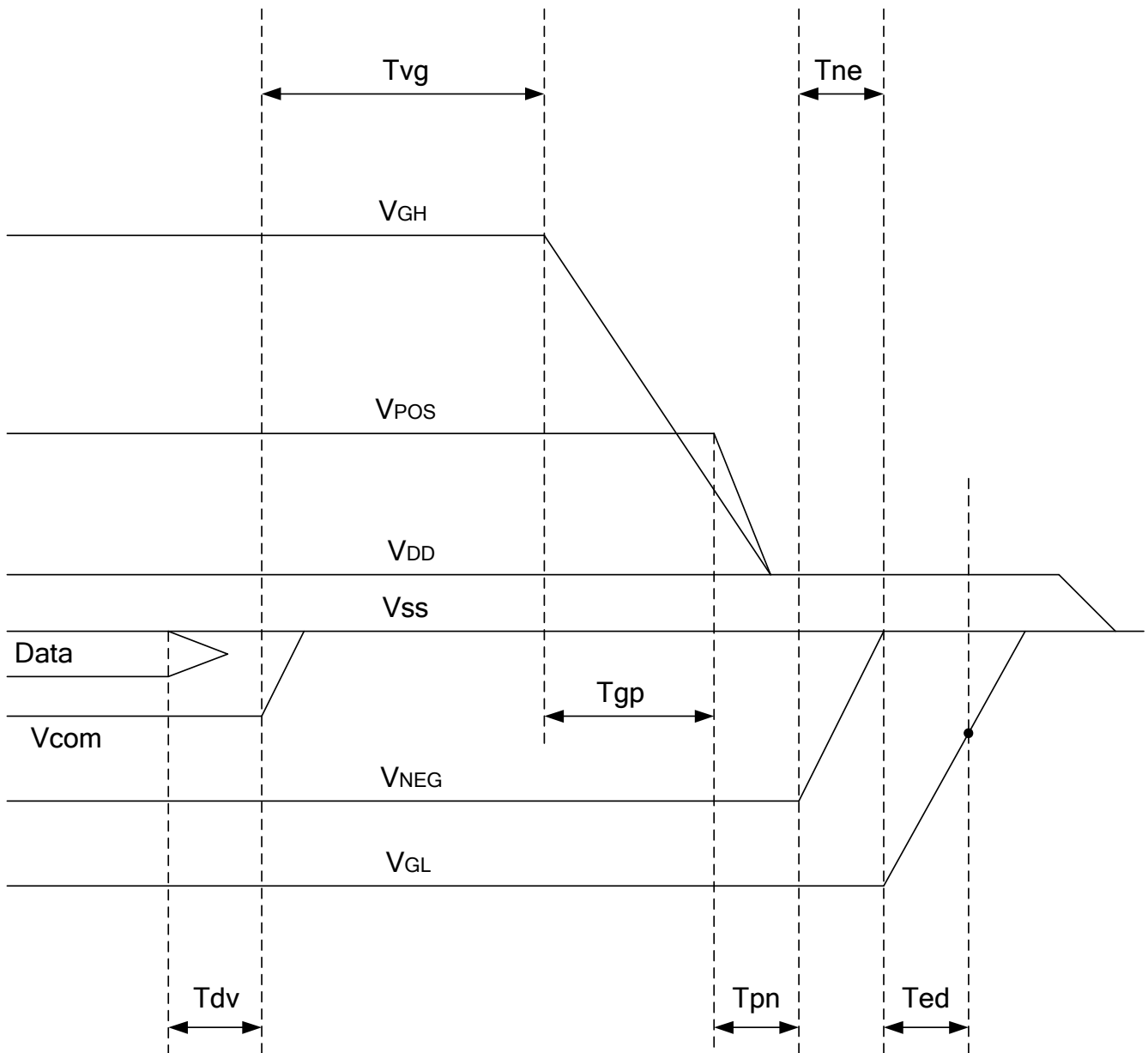
1. VSS → VDD → VNEG → VPOS (Source driver) → VCOM
2. VSS → VDD → VGL → VGH (Gate driver)

### POWER ON



	Min	Max
Tsd	30us	-
Tdn	100us	-
Tnp	1000us	-
Tpv	100us	-
Tvd	100us	-
Tne	0us	-
Teg	1000us	-
Tgv	100us	-

**POWER OFF**



	Min	Max
Tdv	100 $\mu$ s	-
Tvg	0 $\mu$ s	-
Tgp	0 $\mu$ s	-
Tpn	0 $\mu$ s	-
Tne	0 $\mu$ s	-
Ted	0.5s	Discharged point @ -7.4 Volt

Note1 : Supply voltages decay through pull-down resistors.

Note2 : Begin to turn off VGL power after VNEG and VPOS are completely or almost discharged to VSS state.

Note3 : 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

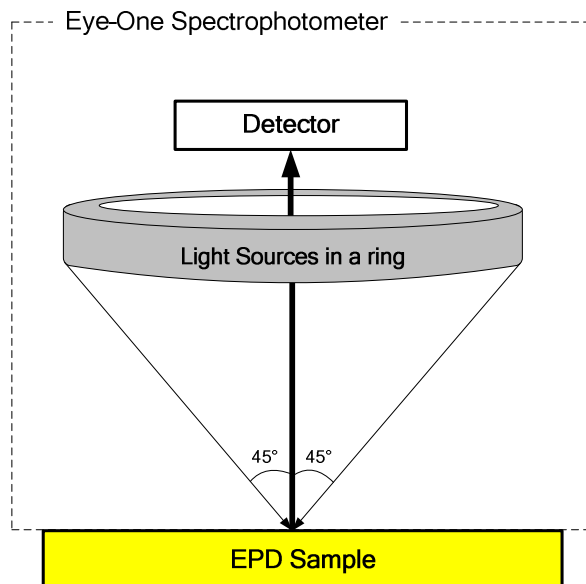
Symbol	Parameter	Conditions	Min	Typ.	Max	Unit	Note
R	Reflectance	White	38	45	-	%	Note 8-1
Gn	N <sub>th</sub> Grey Level	-	-	DS+(WS-DS) xn/(m-1)	-	L*	-
CR	Contrast Ratio	-	10	16	-		-

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 (RI) and the reflectance in a dark area (Rd):  $CR = RI / Rd$



### 8-3) Reflection Ratio

The reflection ratio is expressed as:

$$R = \text{Reflectance Factor}_{\text{white board}} \times (L_{\text{center}} / L_{\text{white board}})$$

$L_{\text{center}}$  is the luminance measured at center in a white area (R=G=B=1).  $L_{\text{white board}}$  is the luminance of a standard white board.

## 9. HANDLING, SAFETY AND ENVIRONMENTAL REQUIREMENTS AND REMARK

<b>WARNING</b>
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.

<b>REMARK</b>
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.

<b>CAUTION</b>
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.

<b>Mounting Precautions</b>
(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 formal 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.

## 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=40% , 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°C, RH=80% , for 240 hrs (Test In White Pattern)	IEC 60 068-2-3CA
7	Temperature Cycle	-25°C→+70°C, 100 Cycles 30min 30min Test in white pattern	IEC 60 068-2-14
8	Solar radiation test	765 W/m <sup>2</sup> , 40°C , for 168 hrs (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	D 8 mm rubber pen, Load:300gf , Speed: 30times/m , Total: 13,500times	

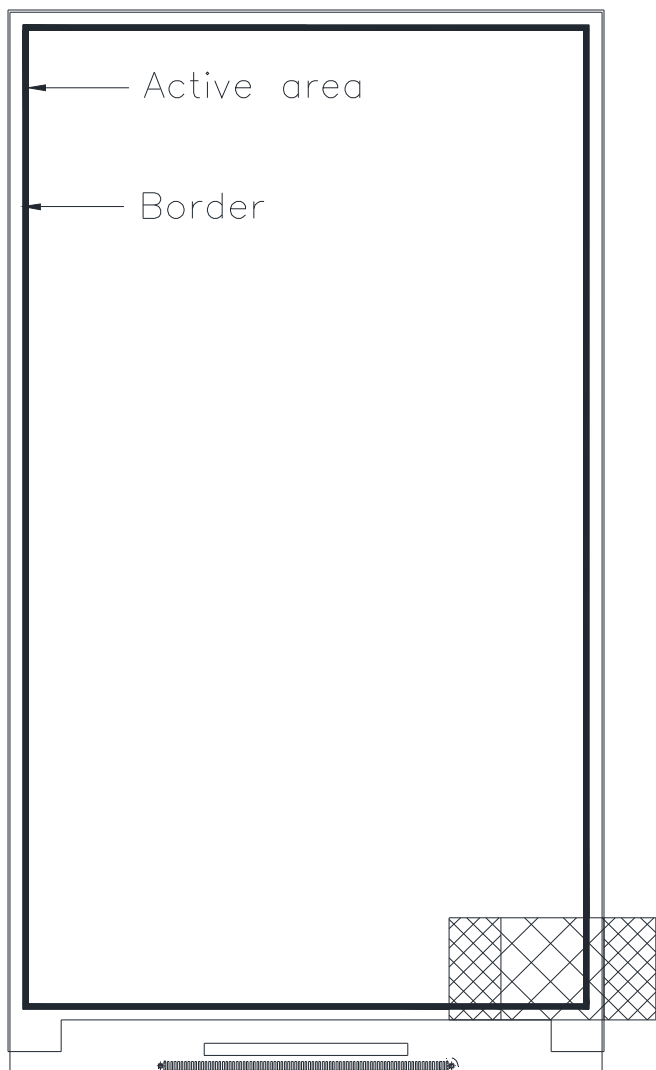
Actual EMC level to be measured on customer application

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.Packing

REV	DESCRIPTION	DESIGN	DATE
00	INITIAL RELEASE	Wesley	'15.07.30

1. One layer include: 1 piece of cushion sheet, 4 pcs module & 1 piece of tray.

2. Q'TY: 96 pcs panel/carton.

3. Dimension: 455\*375\*190mm

Empty tray

1st Layer

2nd Layer

Total 12 Layers

**NOTE:**

1. One layer include: 1 piece of cushion sheet, 4 pcs module & 1 piece of tray.

2. Q'TY: 96 pcs panel/carton.

3. Dimension: 455\*375\*190mm

9	EASY TAPE	96	For Remove Protect Sheet
8	30g 加厚普通白紙(纖維密度7.3*95mm)	2	
7	防鏽劑(保護容積25L)	3	
6	CARTON INTERNAL	1	
5	摺口袋450*380*580mm	1	抗靜電
4	ED052TP1	96	
3	EPE CUSHION SHEET	12	抗靜電
2	TRAY	13	抗靜電
1	EPE FOAM	2	
ITEM	DESCRIPTION	QTY	REMARK

MTL.SPEC.	UNSPECIFIED TOL'S ±5.0mm	REMARK	<b>Eink</b>   元太科技工業股份有限公司 E Ink Holdings Inc.	
APPROVE	Ethan Chen	'15.07.30	SCALE	UNIT
CHECK	Ethan Chen	'15.07.30	1:1	mm
DESIGN	Wesley Huang	'15.07.30	MTL.NO.	SHEET
				1 OF 1
			DWG.TITLE ED052TP1 PACKING Dim	
			DWG.NO.	REV. 01
			A4 SIZE	