

**Version: 0.1**

## TECHNICAL SPECIFICATION

### MODEL NO: ED047TC1

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

☐ Customer's Confirmation

Customer \_\_\_\_\_

Date \_\_\_\_\_

By \_\_\_\_\_

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## Revision History

Rev.	Issued Date	Revised Contents
0.1	Nov.04,2014	Preliminary

# ***TECHNICAL SPECIFICATION***

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## 1. General Description

ED047TC1 is a reflective electrophoretic E Ink<sup>®</sup> technology display module based on active matrix TFT substrate. It has 4.7" 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.

ED047TC1 is for mobile phone use only.

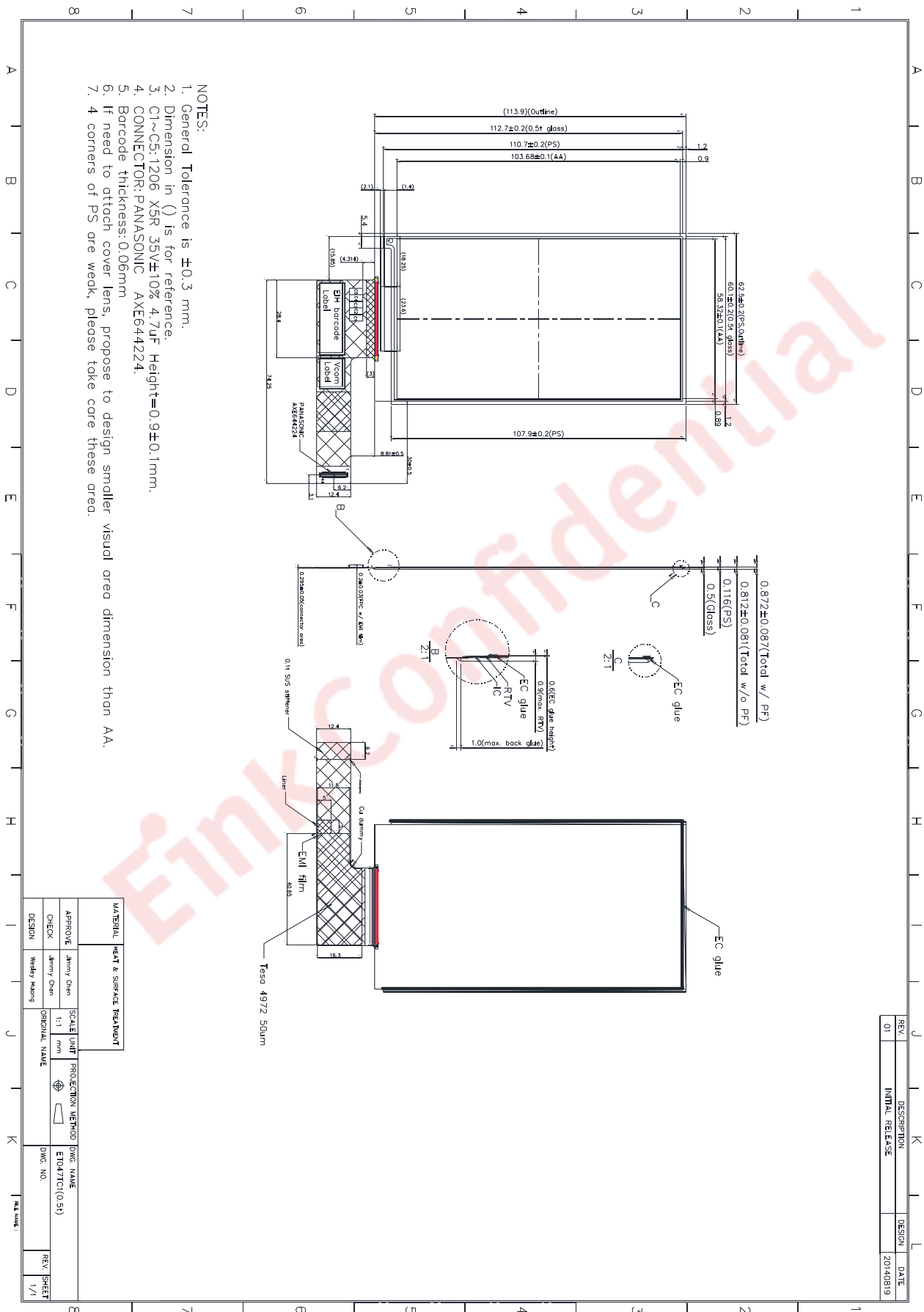
## 2. Features

- High contrast reflective/electrophoretic technology
- 540 x 960 dots resolution
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable
- Commercial temperature range
- Landscape, portrait mode

## 3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	4.7	Inch	
Display Resolution	540 (H)×960(V)	Pixel	
Active Area	58.32 (H)×103.68 (V)	mm	
Pixel Pitch	0.108 (H) × 0.108 (V)	mm	
Pixel Configuration	Rectangle		
Outline Dimension	62.5 (W) × 113.9 (H) × 0.872 (D)	mm	
Module Weight	TBD	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) Connector type: PANASONIC AXE644224

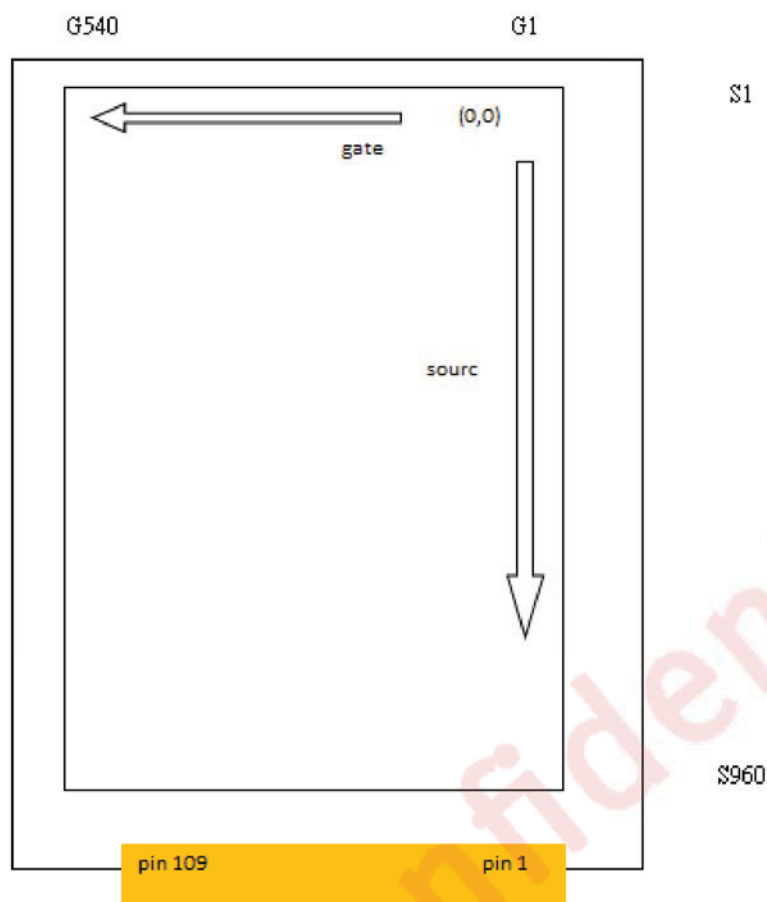
#### Pin Assignment

Pin	Symbol	Description	Remark
1	VNEG	Negative power supply source driver	
2	VPOS	Positive power supply source driver	
3	GND	Ground	
4	GND	Ground	
5	NC	NC	
6	GND	Ground	
7	VDD	Digital power supply drivers (3.3V)	
8	GND	Ground	
9	GND	Ground	
10	XCL	Clock source driver	
11	XLE	Latch enable source driver	
12	XOE	Output enable source driver	
13	XSTL	Start pulse source driver	
14	D0	Data signal source driver	
15	D1	Data signal source driver	
16	D2	Data signal source driver	
17	D3	Data signal source driver	
18	D4	Data signal source driver	
19	D5	Data signal source driver	
20	D6	Data signal source driver	
21	D7	Data signal source driver	
22	NC	NC	
23	TEST	Eink internal test pin	Note1
24	VCOM	Common connection	
25	VGG	Positive power supply gate driver	
26	VCOM	Common connection	
27	VGG	Positive power supply gate driver	
28	GND	Ground	
29	GND	Ground	
30	BORDER	Border connection	
31	VEE	Negative power supply gate driver	
32	BORDER	Border connection	
33	VEE	Negative power supply gate driver	
34	GND	Ground	
35	GND	Ground	
36	CKV	Clock gate driver	
37	SPV	Start pulse gate driver	
38	MODE 1	Output mode selection gate driver	
39	NC	NC	
40	NC	NC	

Pin	Symbol	Description	Remark
41	NC	NC	
42	NC	NC	
43	NC	NC	
44	NC	NC	

**Note1:**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 +7	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	VGG	-0.3 to +45	V	--
Supply Voltage	VEE	-25.0 to +0.3	V	--
Supply Range	VGG-VEE	-0.3 to +45	V	--
Operating Temp. Range	TOTR	0 to +50	°C	--
Storage Temperature	TSTG	-25 to +70	°C	--

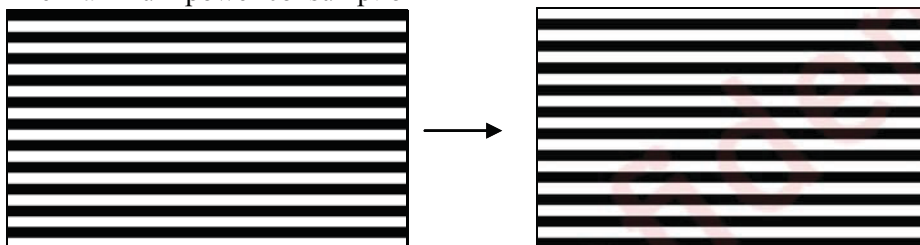
**6-2) Display Module DC characteristics**

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	-	TBD	TBD	mA
Gate Negative supply	V <sub>EE</sub>		-21	-20	-19	V
	I <sub>EE</sub>	V <sub>EE</sub> = -20V	-	TBD	TBD	mA
Gate Positive supply	V <sub>GG</sub>		21	22	23	V
	I <sub>GG</sub>	V <sub>GG</sub> = 22V	-	TBD	TBD	mA
Source Negative supply	V <sub>NEG</sub>		-15.4	-15	-14.6	V
	I <sub>NEG</sub>	V <sub>NEG</sub> = -15V	-	TBD	TBD	mA
Source Positive supply	V <sub>POS</sub>		14.6	15	15.4	V
	I <sub>POS</sub>	V <sub>POS</sub> = 15V	-	TBD	TBD	mA
Border supply	V <sub>COM</sub>		-	Adjusted	-	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>		-	Adjusted	-	V
	I <sub>COM</sub>		-	TBD	-	mA
Panel Power	P		-	TBD	TBD	mW
Standby power panel	P <sub>STBY</sub>		-	-	0.1	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 7-1)
- 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 7-2)
- 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 TBD mA

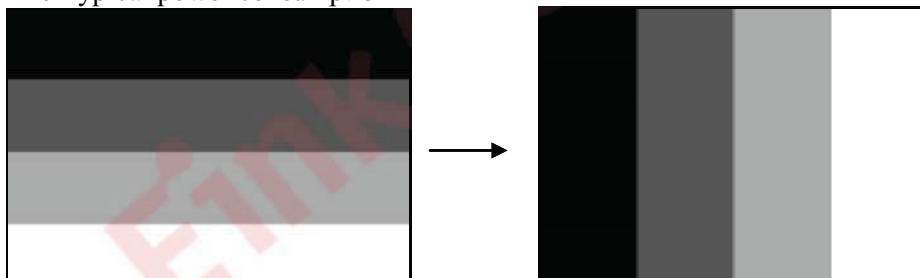
#### Note 6-1

The maximum power consumption



#### Note 6-2

The Typical power consumption



### 6-3) Refresh Rate

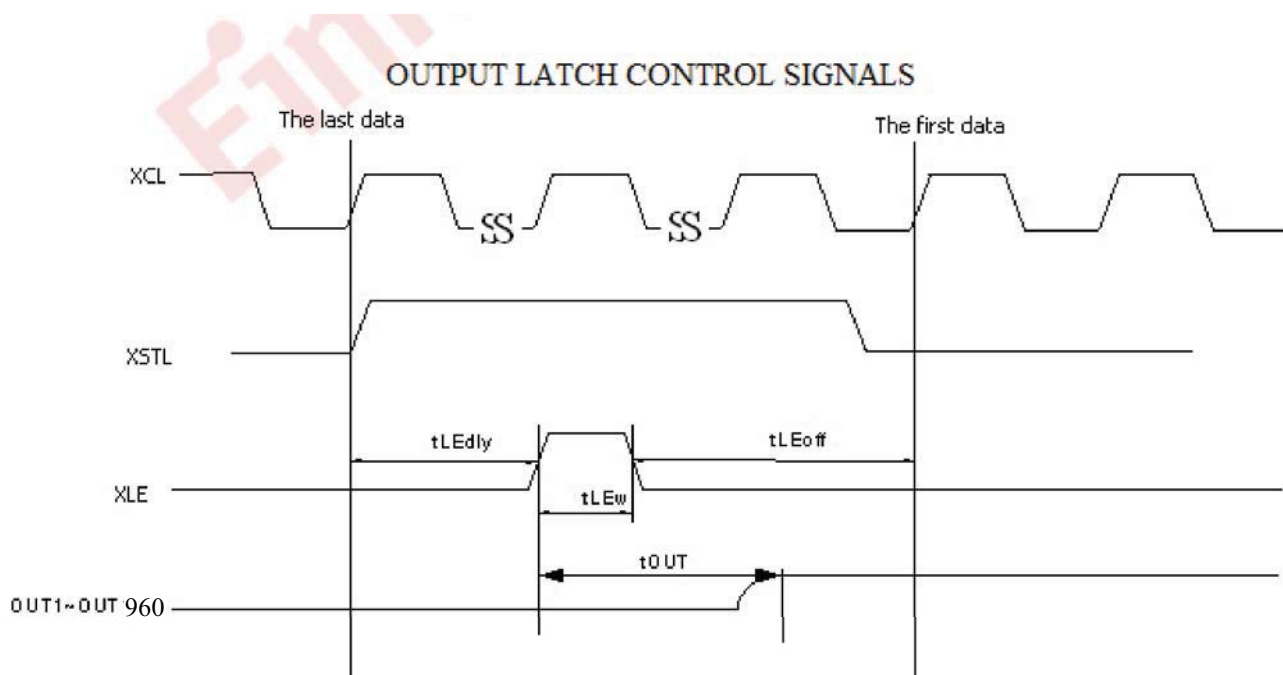
The module ED047TC1 is applied at a maximum screen refresh rate of 85Hz.

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

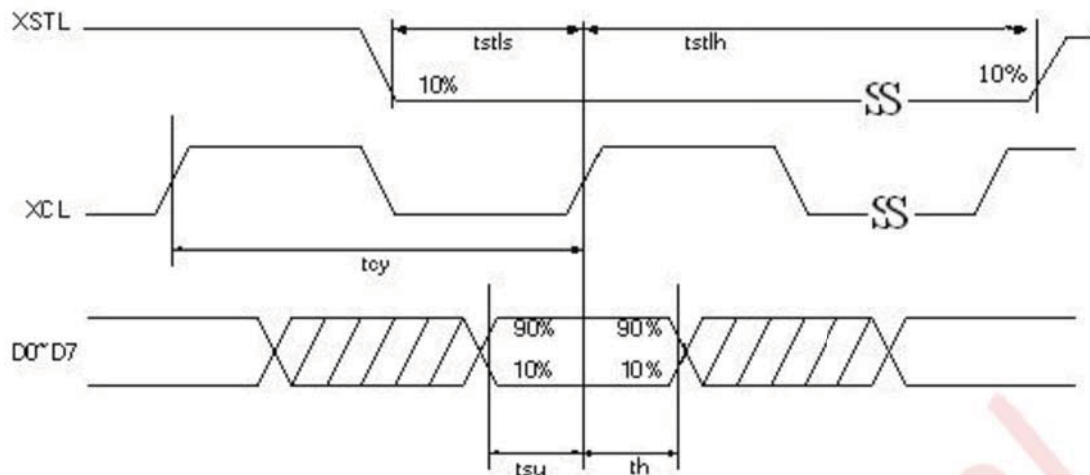
**6-3 ) Display Module AC characteristics**

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

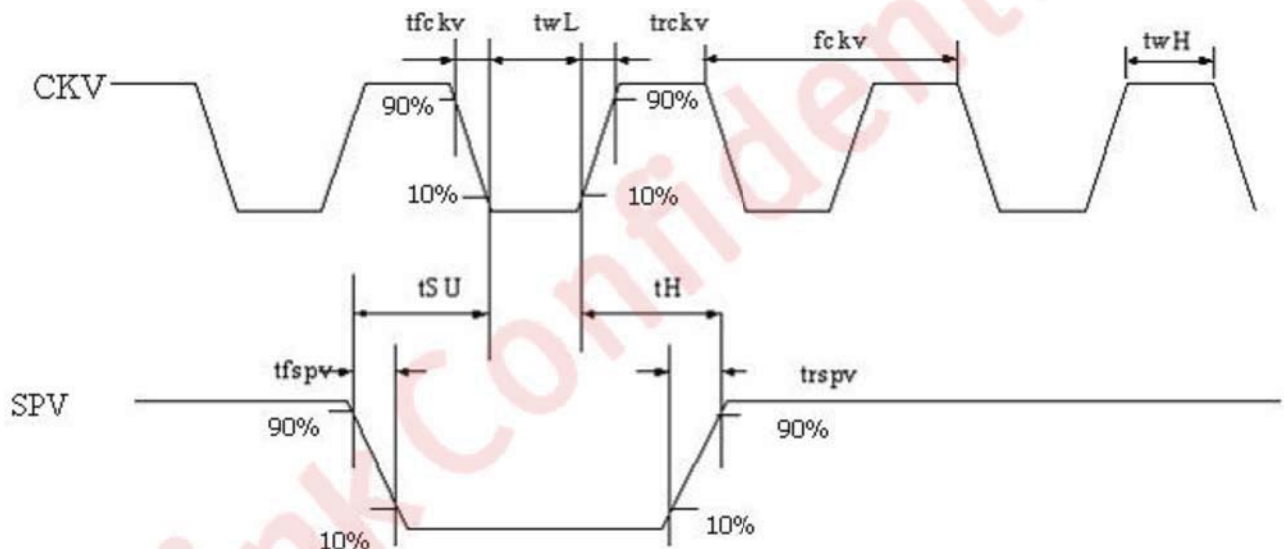
Parameter	Symbol	Min.	Typ.	Max.	Unit
Clock frequency	fckv	-	-	200	kHz
Minimum “L” clock pulse width	twL	0.5	-	-	us
Minimum “H” clock pulse width	twH	0.5	-	-	us
Clock rise time	trckv	-	-	100	ns
Clock fall time	tfckv	-	-	100	ns
SPV setup time	tSU	100	-	twH-100	ns
SPV hold time	tH	100	-	twH-100	ns
Pulse 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



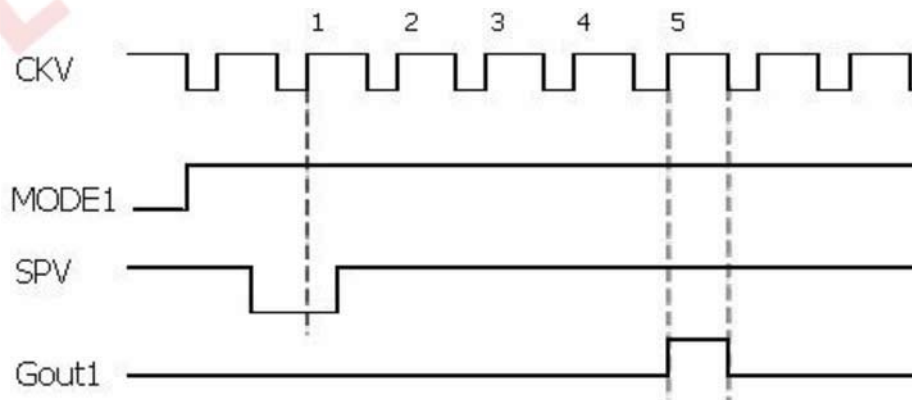
### CLOCK & DATA TIMING



### CKV & SPV TIMING



### GATE OUTPUT TIMING



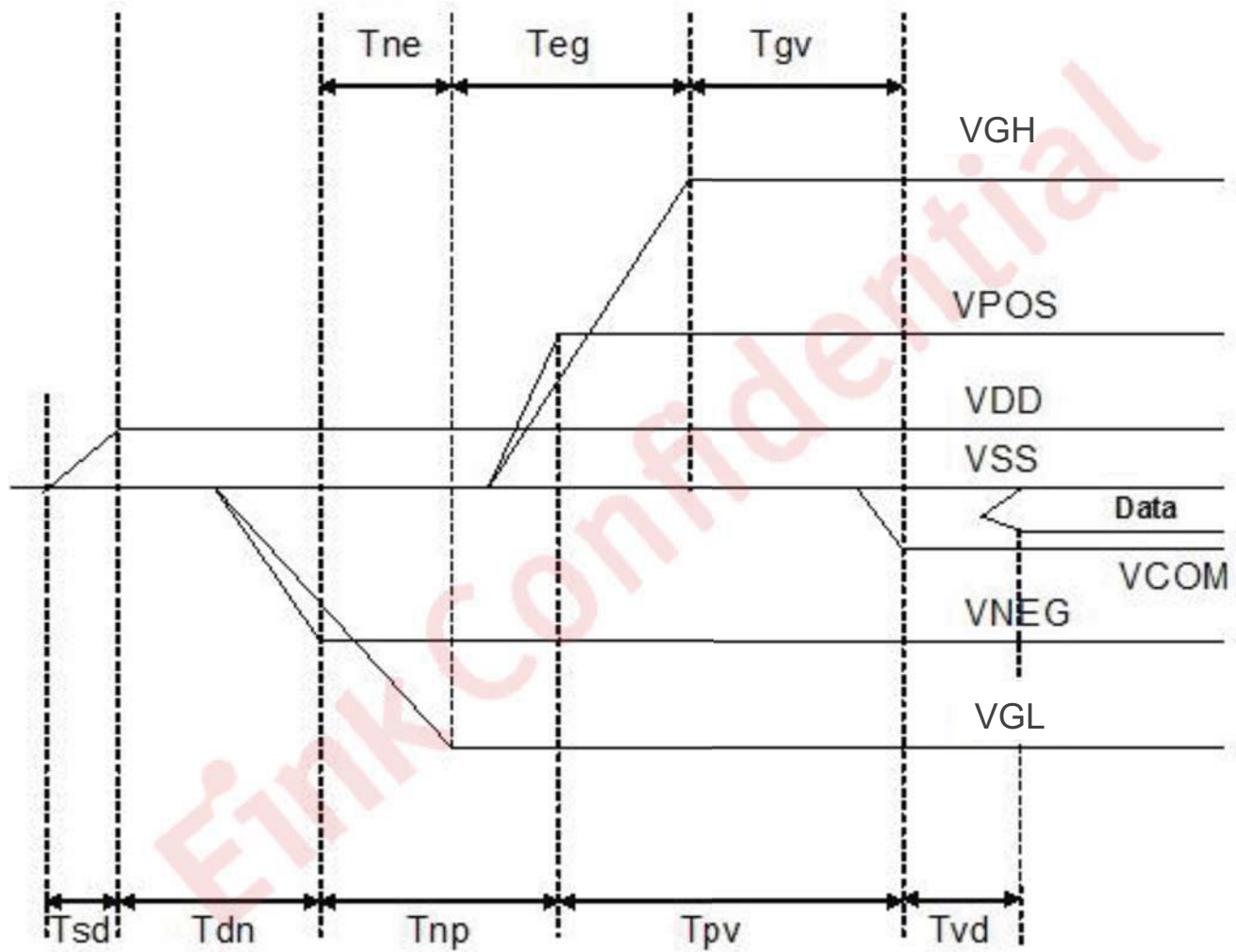
Note : First gate line on timing  
After 5CKV , gate line is on .

## 7. Power Sequence

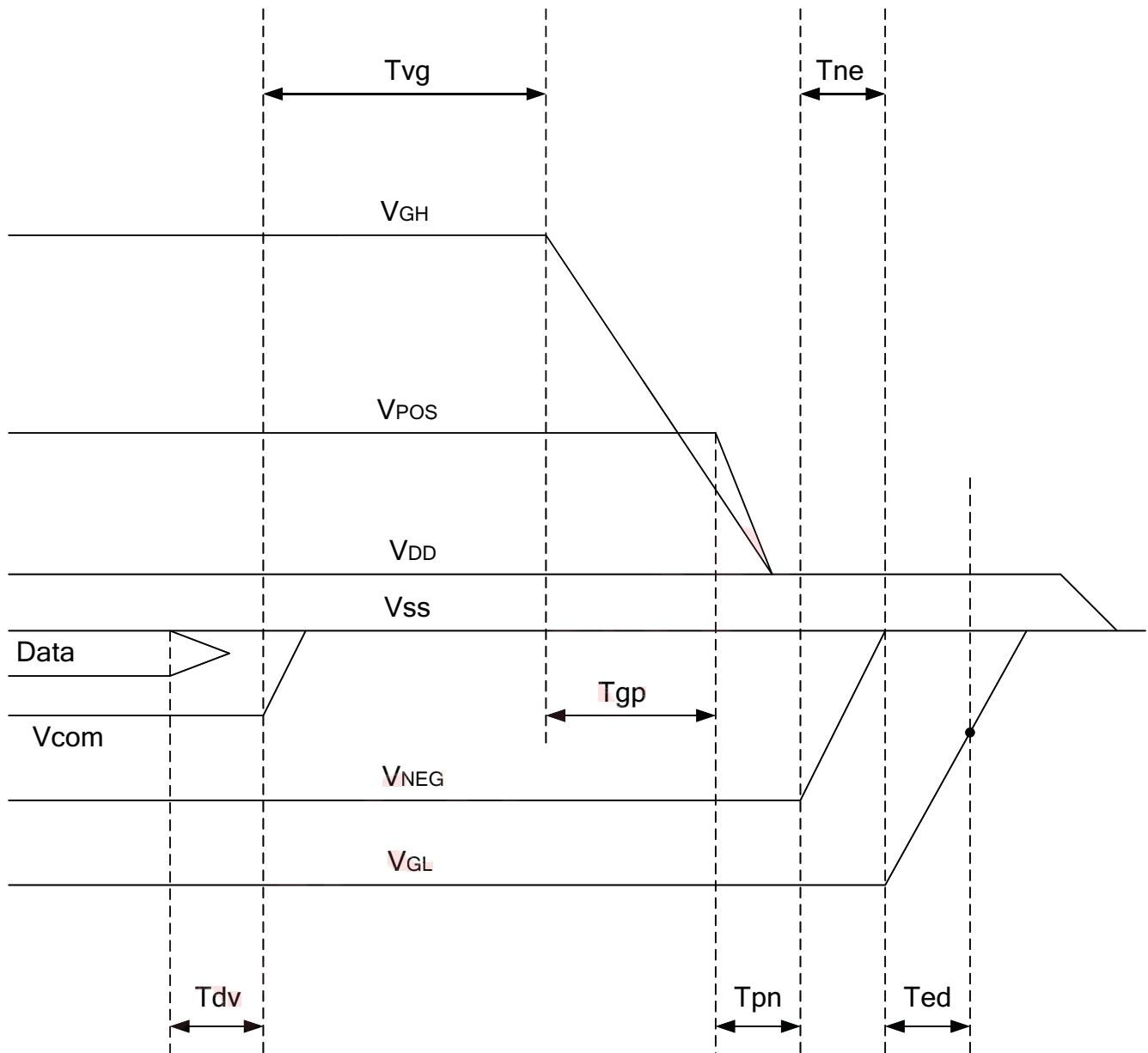
Power Rails must be sequenced in the following order :

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	
T <sub>dv</sub>	100 $\mu$ s	-	
T <sub>vg</sub>	0 $\mu$ s	-	
T <sub>gp</sub>	0 $\mu$ s	-	
T <sub>pn</sub>	0 $\mu$ s	-	
T <sub>ne</sub>	0 $\mu$ s	-	
T <sub>ed</sub>	0.5s	-	Discharged point @ -7.4 Volt

Note1 : Supply voltages decay through pull-down resistors.

Note2 : Begin to turn off V<sub>G</sub> power after V<sub>NEG</sub> and V<sub>POS</sub> are completely or almost discharged to GND state.

Note3 : V<sub>G</sub> must remain negative of V<sub>com</sub> 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

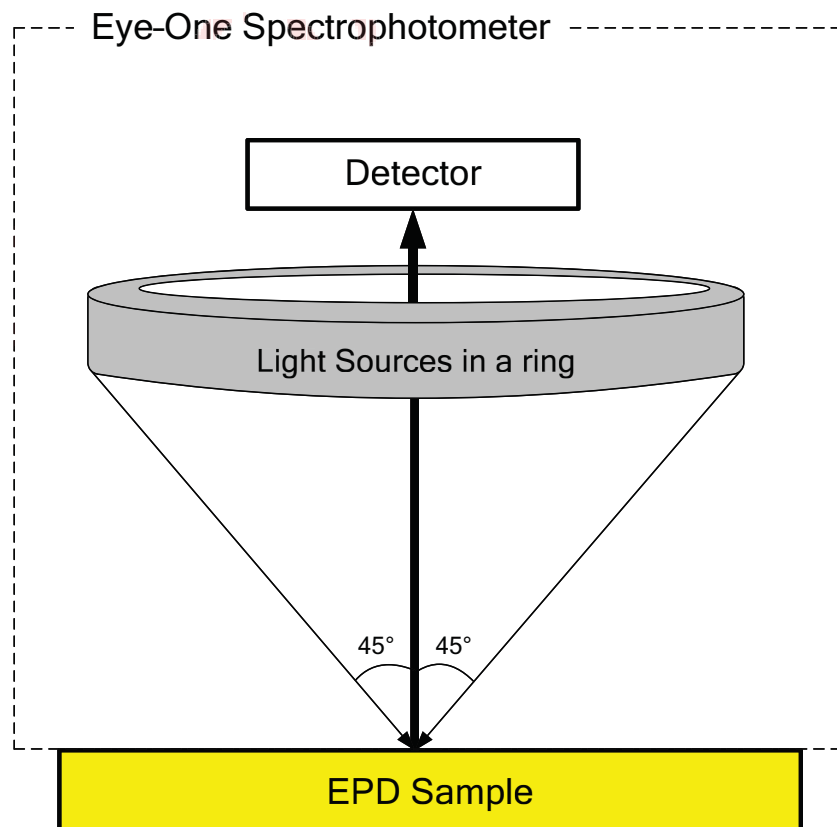
Symbol	Parameter	Conditions	Min	Typ.	Max	Unit	Note
R	Reflectance	White	30	35	-	%	Note 8-1
Gn	N <sub>th</sub> Grey Level	-	-	$DS + (WS - DS) \times n / (m - 1)$	-	L*	-
CR	Contrast Ratio	-	10	12	-		-

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 ENVIROMENTAL 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 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.

**10. Reliability test**

TBD

**11.Bar Code definition**

EDV    00    4    01    1    I    7    4    00361    A    T  
 1    2    3    4    2    5    6    2    7    2    8

1 : EPD model code:

ED047TC1: EDV

2 : Internal control codes:

3 : FPL reversion code

V220:6 V220E:8

4 : FPL batch code:

01~99	001~099	G0~G9	160~169	Q0~Q9	230~239	X0~X9	300~309
A0~A9	100~109	H0~H9	170~179	R0~R9	240~249	Y0~Y9	310~319
B0~B9	110~119	J0~J9	180~189	S0~S9	250~259	Z0~Z9	320~329
C0~C9	120~129	K0~K9	190~199	T0~T9	260~269		
D0~D9	130~139	L0~L9	200~209	U0~U9	270~279		
E0~E9	140~149	M0~M9	210~219	V0~V9	280~289		
F0~F9	150~159	N0~N9	220~229	W0~W9	290~299		

5 : Year:

N: 2013 / P: 2014 / Q: 2015 / R: 2016 /... / Z: 2024

6 : Month:

1:Jan. 2:Feb. ... 9:Sep. A:Oct. B:Nov. C:Dec.

7 : Serial number

00000-99999

8 : MFG code:

TOC FAB3 : T ; TOC FAB2 : Y ; TOC FAB1 : K ; EIH : P ; MOS : S ; Microveiw : G ;  
 TYT FAB5 : G ; TYT FAB4 : L

**12. Border definition**

TBD

**13.Block Diagram**

TBD

**14.Packing**

TBD