**Version: <u>TV0.1 (Tentative)</u>**

<div style="border:1px solid black;">

# TECHNICAL SPECIFICATION

# MODEL NO:10.3inch e-Paper (D)

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The content of this information is subject to be changed without notice. Please contact Waveshare for further information.

☐ Customer's Confirmation

Customer _____

Date _____

By _____

☐ E Ink's Confirmation

| Dep | PM | PjM | FAE | Panel Design | Electronic Design | Mechanical Design | Product Verification | Prepared By |
|------|-----|-----|-----|--------------|-------------------|-------------------|----------------------|-------------|
| Sign |     |     |     |              |                   |                   |                      |             |

# Revision History

| Rev. | Issued Date | Revised Contents |
|------|-------------|------------------|
| TV0.1 | Feb/16,2016 | Tentative |

# *TECHNICAL SPECIFICATION*

## *CONTENTS*

# 1. General Description

10.3inch e-Paper (D) is a reflective electrophoretic E Ink and Mobius technology display module based on active matrix TFT substrate. It has 10.3" active area with 1404 x 1872 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
➢ 1404x 1872 Mobius display
➢ 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 | 10.3 | Inch | |
| Display Resolution | 1404(H) × 1872(V) | Pixel | |
| Active Area | 157.248(H) ×209.664 (V) | mm | |
| Pixel Pitch | 0.112(H) ×0.112(V) | mm | |
| Pixel Configuration | Rectangle | | |
| Outline Dimension | 165.8(H) × 227.70(V) ×0.647(D) | mm | |
| Module Weight | TBD | g | |
| Number of Gray | 16 Gray Level (monochrome) | | |
| Display operating mode | Reflective mode | | |

# 4. Mechanical Drawing of EPD Module
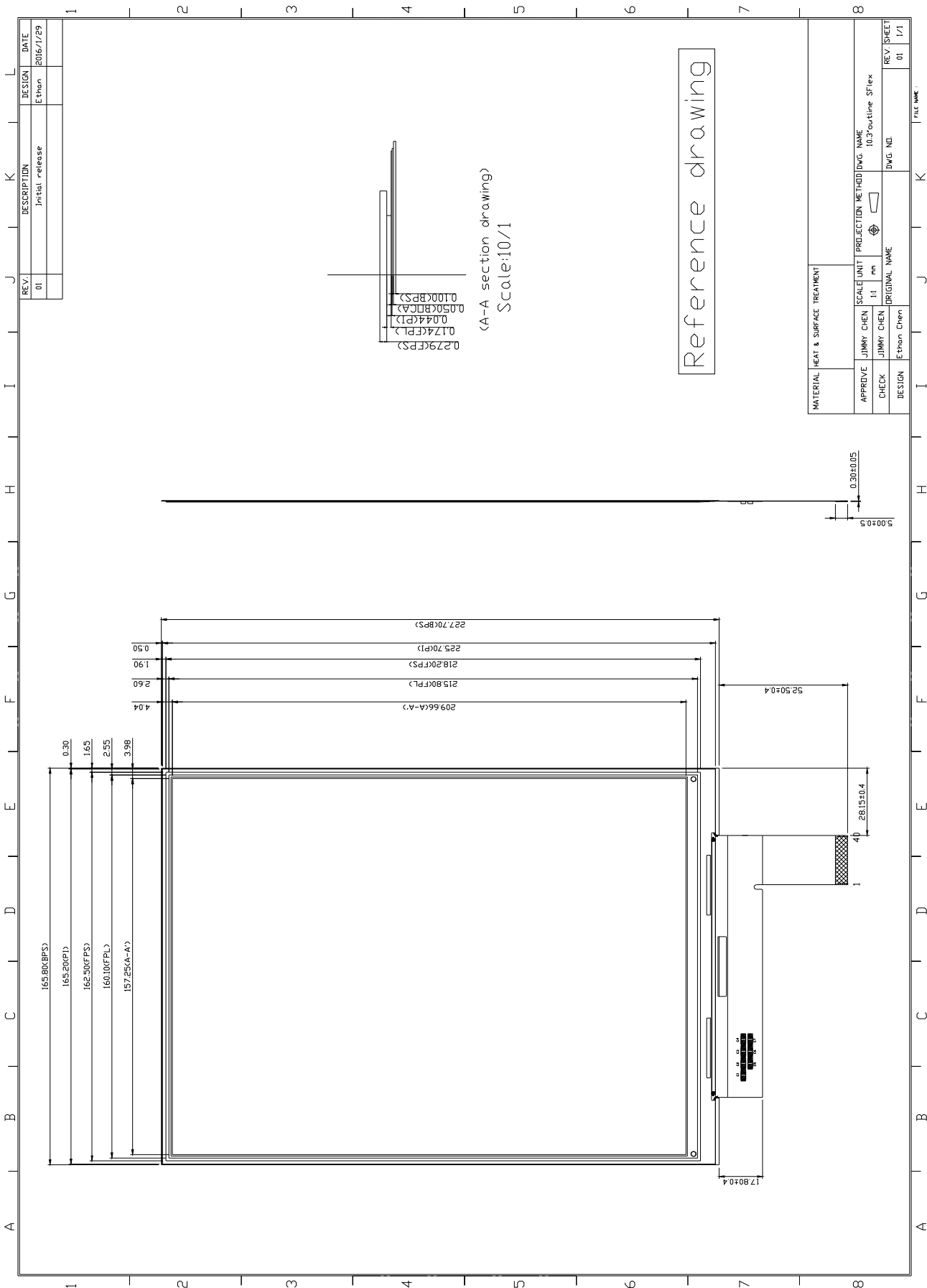
## 5. Input/Output Interface

### 5-1)Pin Assignment

Connector type：196033-40041

| Pin # | Signal | Description | Remark |
|---|---|---|---|
| 1 | VGL | Negative power supply gate driver | |
| 2 | NC | NO Connection | |
| 3 | VGH | Positive power supply gate driver | |
| 4 | NC | NO Connection | |
| 5 | VDD | Digital power supply drivers | |
| 6 | MODE | Output mode selection gate driver | |
| 7 | CKV | Clock gate driver | |
| 8 | SPV | Start pulse gate driver | |
| 9 | VSS | Ground | |
| 10 | VCOM | Common voltage | |
| 11 | VDD | Digital power supply drivers | |
| 12 | VSS | Ground | |
| 13 | XCL | Clock 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 | VSS | Ground | |
| 23 | D8 | Data signal source driver | |
| 24 | D9 | Data signal source driver | |
| 25 | D10 | Data signal source driver | |
| 26 | D11 | Data signal source driver | |
| 27 | D12 | Data signal source driver | |
| 28 | D13 | Data signal source driver | |
| 29 | D14 | Data signal source driver | |
| 30 | D15 | Data signal source driver | |
| 31 | XSTL | Start pulse source driver | |
| 32 | XLE | Latch enable source driver | |
| 33 | XOE | Output enable source driver | |
| 34 | NC | NO Connection | |
| 35 | NC | NO Connection | |
| 36 | VPOS | Positive power supply source driver | |
| 37 | NC | NO Connection | |
| 38 | VNEG | Negative power supply source driver | |
| 39 | NC | NO Connection | |
| 40 | Border | Border connection | |

## 5-2) Panel Scan direction
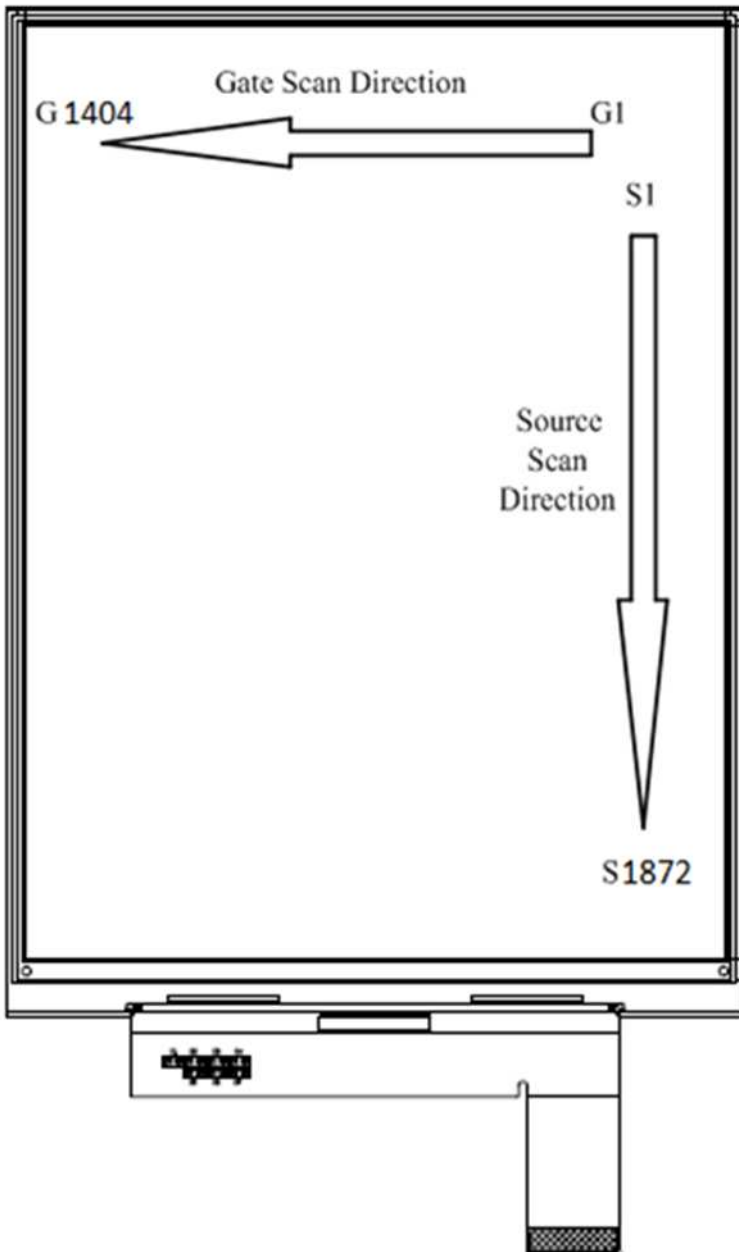
# 7. Electrical Characteristics

## 7-1) Absolute Maximum Ratings:

| Parameter | Symbol | Rating | Unit | Remark |
|---|---|---|---|---|
| Logic Supply Voltage | VDD | -0.3 to +5 | 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 | VGH | -0.3 to +46 | V | -- |
| Supply Voltage | VGL | -25 to +0.3 | V | -- |
| Supply Range | VGH-VGL | -0.3 to +46 | V | -- |
| Operating Temp. Range | TOTR | 0 to +50 | ℃ | -- |
| Storage Temperature | TSTG | -25 to +70 | ℃ | -- |

## 7-2) Panel 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 |
| | $I_{VDD}$ | $V_{DD}$=3.3V | - | TBD | - | mA |
| Gate Negative supply | VGL | | -21 | -20 | -19 | V |
| | $I_{GL}$ | $V_{GL}$ =-20V | - | TBD | - | mA |
| Gate Positive supply | VGH | | 24 | 25 | 26 | V |
| | $I_{GH}$ | $V_{GH}$ = 25V | - | TBD | - | mA |
| Source Negative supply | $V_{NEG}$ | | -15.4 | -15 | -14.6 | V |
| | $I_{NEG}$ | $V_{NEG}$ = -15V | - | TBD | - | mA |
| Source Positive supply | $V_{POS}$ | | 14.6 | 15 | 15.4 | V |
| | $I_{POS}$ | $V_{POS}$ = 15V | - | TBD | - | mA |
| Border supply | $V_{COM}$ | | - | Adjusted | - | V |
| Asymmetry source | $V_{Asym}$ | $V_{POS}$+$V_{NEG}$ | -800 | 0 | 800 | mV |
| Common voltage | $V_{COM}$ | | - | Adjusted | - | V |
| | $I_{COM}$ | | - | TBD | - | mA |
| Panel Power | P | | - | TBD | - | mW |
| Standby power panel | $P_{STBY}$ | | - | - | - | mW |

- The maximum power consumption is measured using 85 Hz 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 85 Hz 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 Waveshare.
- Vcom is recommended to be set in the range of assigned value ± 0.1V
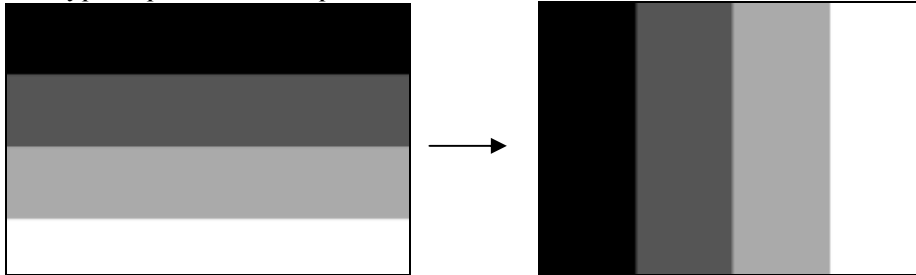- The maximum $I_{COM}$ inrush current is about TBD mA

Note7-1

The maximum power consumption
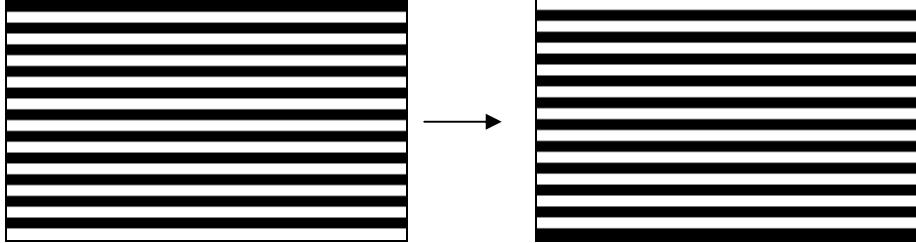


Note7-2

The typical power consumption

### 7-4) Panel 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 | - | 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 | DC | 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 VDD=1.7V to 2.1V) | tLEw | 300 | - | - | ns |
| XLE off delay time | tLEoff | 200 | - | - | ns |
| Output setting time to +/- 30mV($C_{load}$=200pF) | tout | - | - | 20 | us |

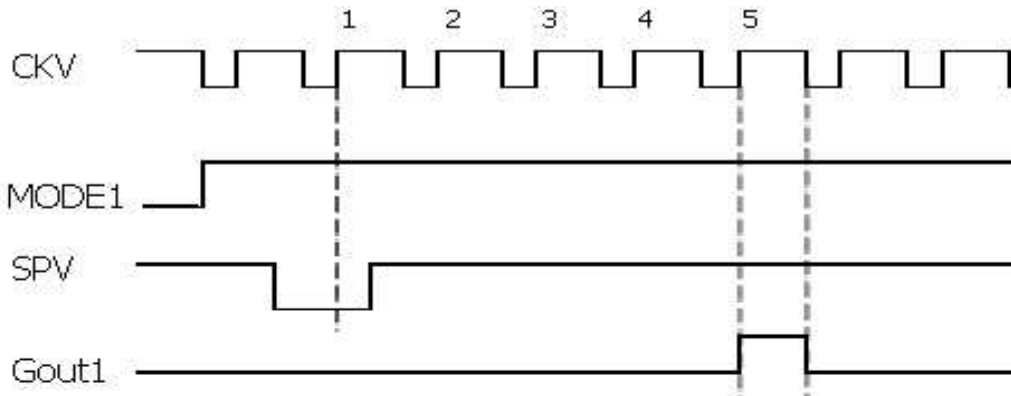OUTPUT LATCH CONTROL SIGNALS
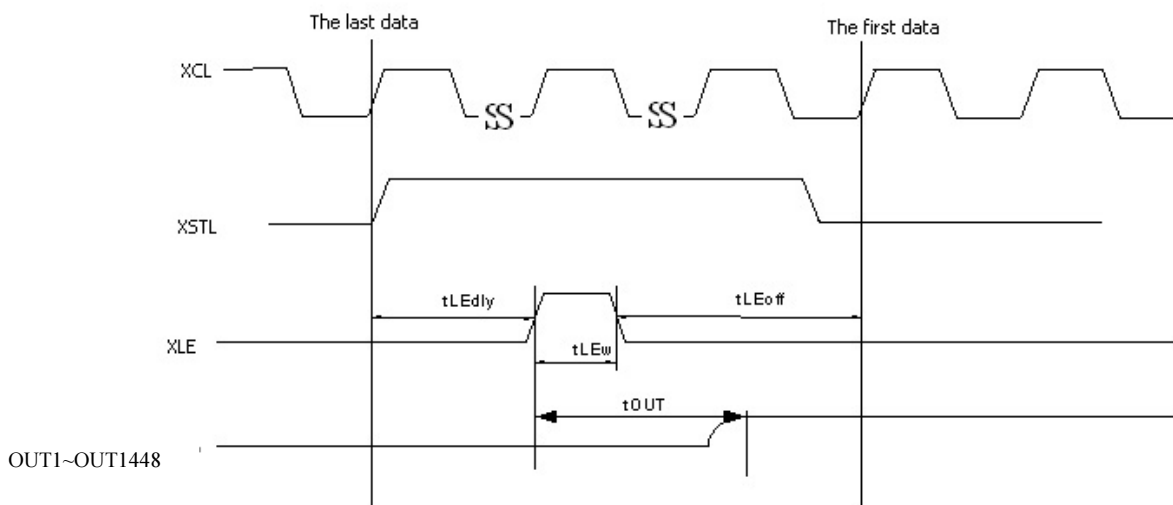
## CLOCK & DATA TIMING
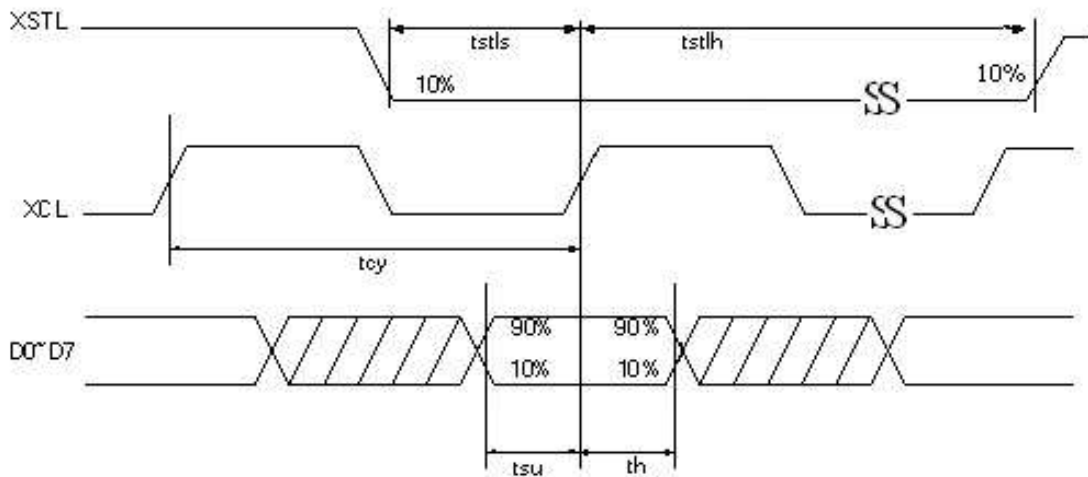


## CKV & SPV TIMING
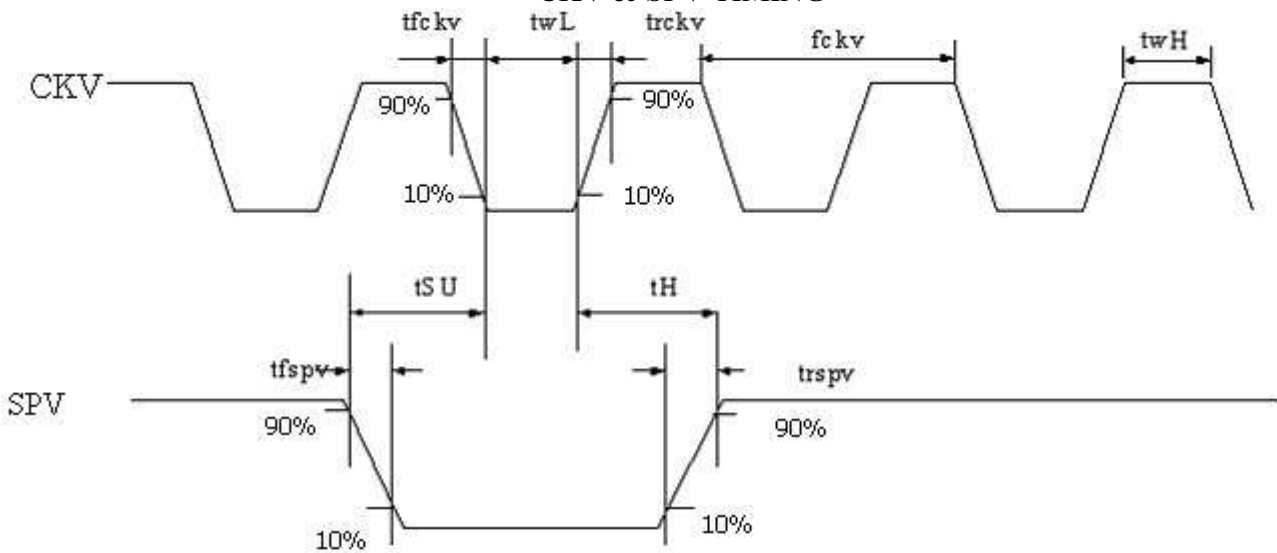


## GATE OUTPUT TIMING



**Note：First gate line on timing**

**7-5) Refresh Rate**

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

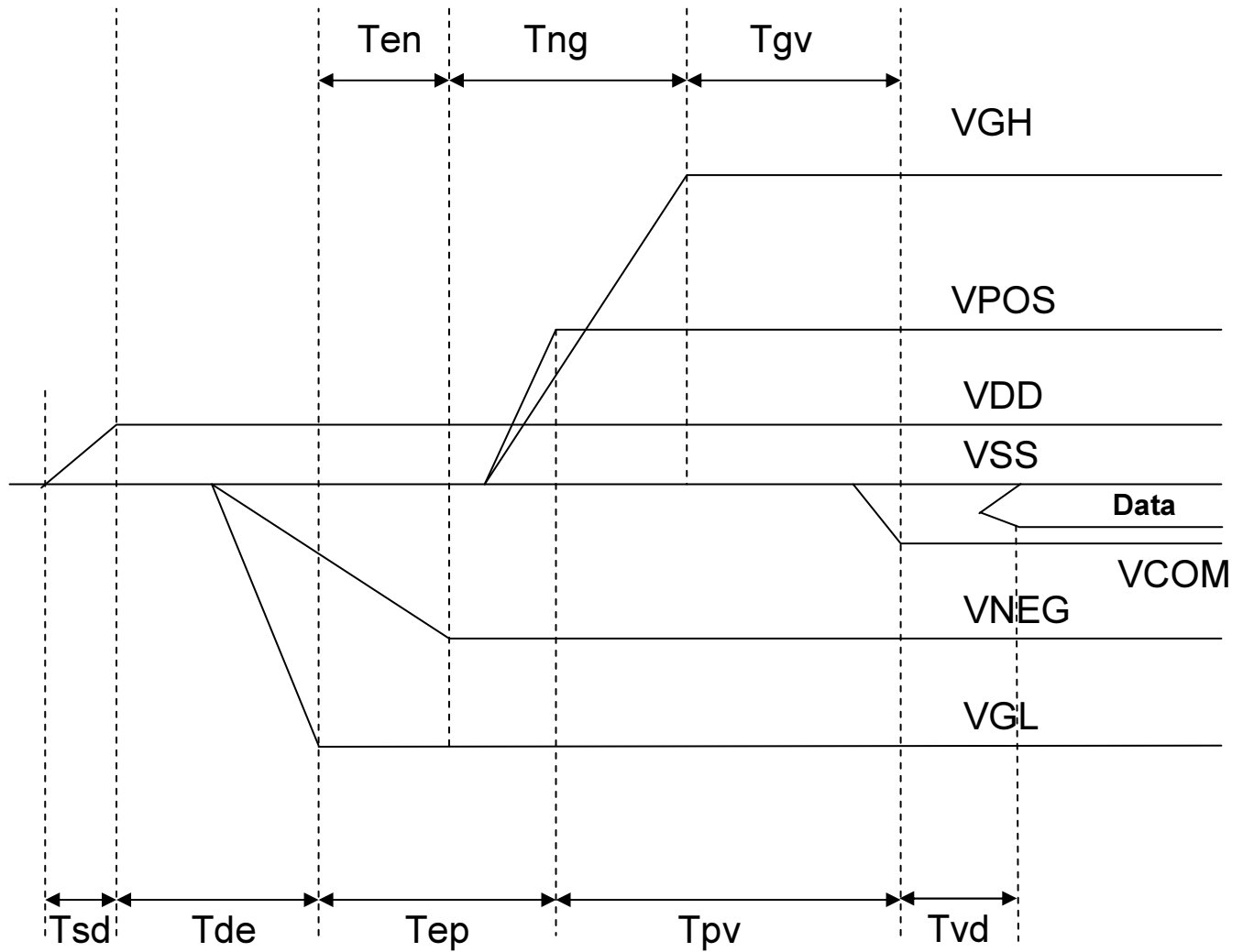|  | Min | Max |
|---|---|---|
| **Refresh Rate** | - | 85 Hz |

**7-6) Controller Timing**

**Timing Parameters Table**

## 8. Power Sequence
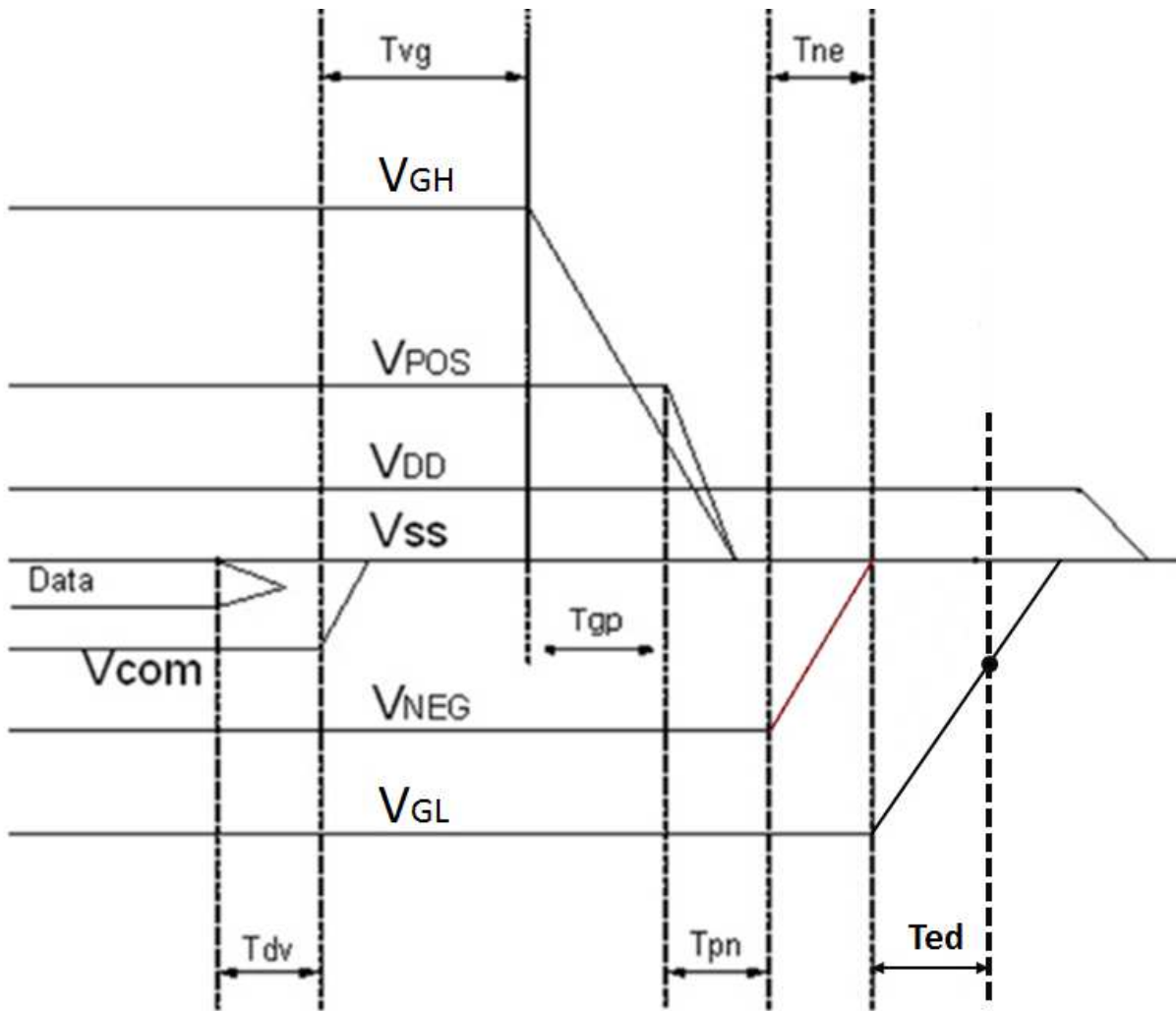
Power Rails must be sequenced in the following order：

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 8-1：Supply voltages decay through pull-down resistors.

Note 8-2 : Begin to turn off VGL power after VNEG and VPOS are completely or almost discharged to GND state.

Note 8-3：VGL must remain negative of Vcom during decay period

## 9. Optical characteristics

### 9-1) Specifications

Measurements are made by PR655 with MS-75 or equivalent SepctaScan Colorimeter with that the illumination is at an angle 45° from the perpendicular at the center of sample surface, and the detector is perpendicular unless otherwise specified.

$T = 25^{o}C$

| Symbol | Parameter | Conditions | | Min | Typ. | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| R | Reflectance | White | | TBD | TBD | - | % | Note 9-1 |
| Gn | $N_{th}$ Grey Level | - | Front Light off | - | $DS+(WS-DS)\times n/(m-1)$ | - | L* | - |
| CR | Contrast Ratio | - | | TBD | TBD | - | - | Note 9-2 |

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

### 9-2) 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
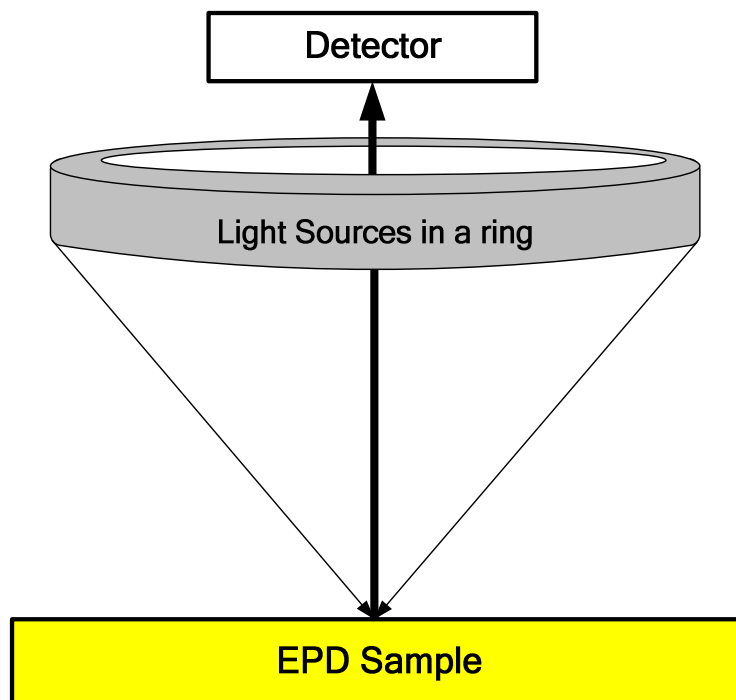
## 9-3) Reflection Ratio

The reflection ratio is expressed as:

R = Reflectance Factor$_{\text{white board}}$    x    ( 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. Both are measured with equivalent illumination source. The viewing angle shall be no more than 2 degrees.

## 10. HANDLING, SAFETY AND ENVIROMENTAL 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. |

## 11. Reliability test
**TBD**
                                                                                                    19

## 12. Block Diagram
**TBD**

## 13.Packing
**TBD**