



## **4.0 inch E-paper Display Series**

**GDEP040E01**

Dalian Good Display Co., Ltd.

# Product Specifications



<b>Customer</b>	<b>Standard</b>
<b>Description</b>	<b>4.0" E-PAPER DISPLAY</b>
<b>Model Name</b>	<b>GDEP040E01</b>
<b>Date</b>	<b>2024/01/29</b>
<b>Revision</b>	<b>1.0</b>

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## 1. Over View

The GDEY040E01 is a reflective electrophoretic E Ink Spectra 6 Display module based on glass active matrix TFT substrate and E Ink Advanced Color ePaper (Spectra 6) technology. It has 4.0" active area with 400(H) x 600(V) pixels, the display is capable to display images with full colors driven by the all in one display controller and the associated waveform file.

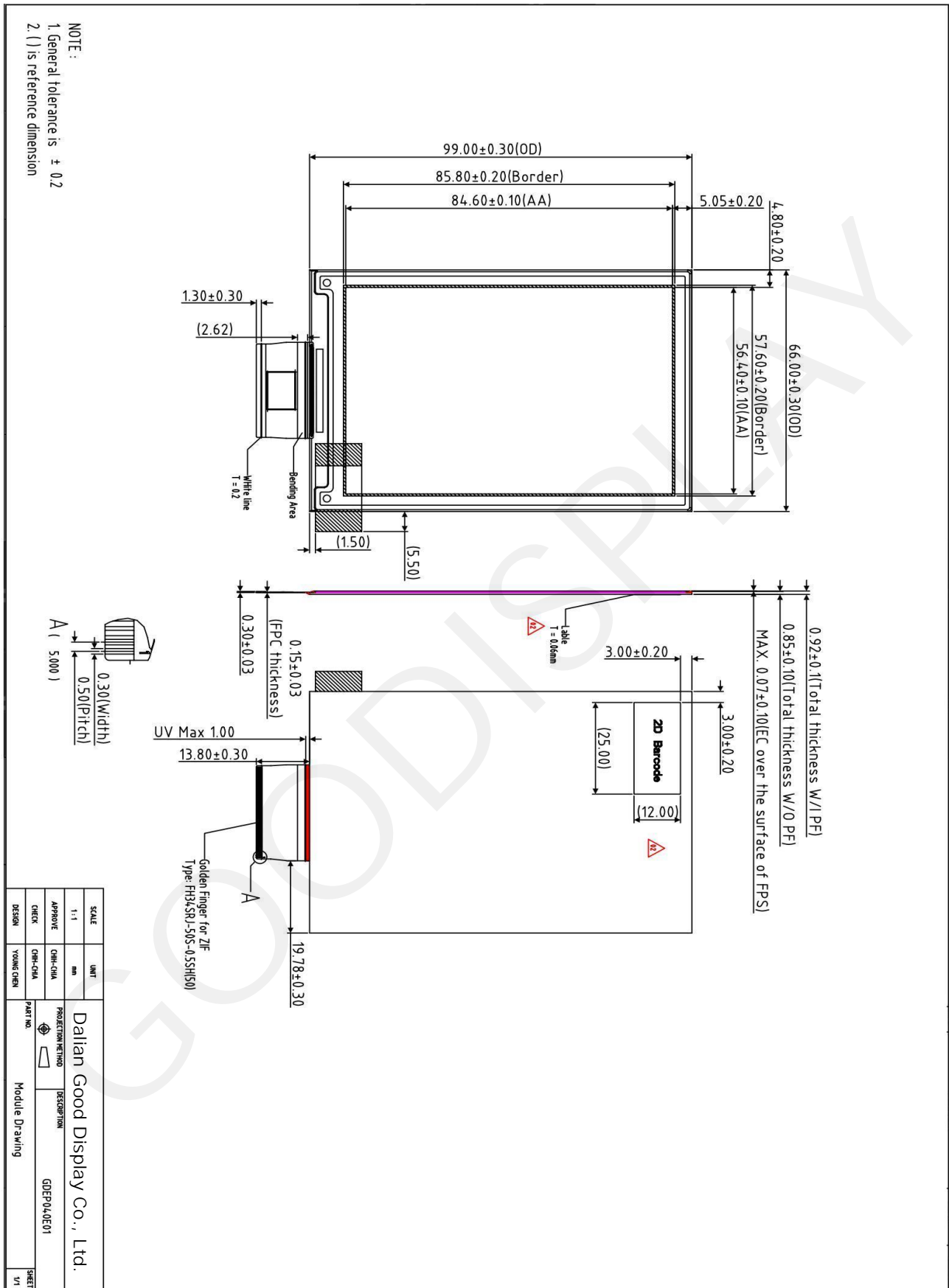
## 2. Features

- High contrast reflective/electrophoretic technology
- 400(H) x 600(V) display
- Full colours
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable
- Commercial temperature range
- Portrait type
- Glass substrate
- All in one IC that integrated source driver, gate driver, TCON, PMIC and OTP memory in the module.

## 3. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	4.0	Inch	
Display Resolution	400(H) x 600(V)	Pixel	
Active Area	56.4(H) x 84.6(V)	mm	
Pixel Pitch	0.141(H) x 0.141(V)	mm	180 PPI
Pixel Configuration	Square		
Outline Dimension	66.0(H) x 99.0(H) x 0.85 (D)	mm	w/o PF
Module Weight	11.92±1.19	g	
Number of Gray	Full colors		
Display operating mode	Reflective mode		
Surface treatment	AG		

## 4. Mechanical Drawing of EPD module



## 5. Input /Output Pin Assignment

### 5.1 Connector type: Golden Finger for ZIF Type FH34SRJ-50S-0.5SH(50)

#### 5.2 Pin assignment

Pin #	Type	Single	Description	Remark
1		NC	No connection and do not connect with other NC pins	
2	P	TFT_VCOM	TFT_VCOM driving voltage	
3	P	FPL_VCOM	FPL_VCOM driving voltage	
4		NC	NC	
5	I/O	GDRH	N-Channel MOSFET Gate Drive Control	
6	I/O	RESEH	Current Sense Input for the Control Loop	
7		GDRL	Reserved	
8	P	GND	Ground	
9	I/O	GDRC	P-Channel MOSFET Gate Drive Control	
10	I/O	RESEC	Current Sense Input for the Control Loop	
11	P	VPC	VPC driving voltage	
12	P	GND	Ground	
13	P	VGL	Negative Gate driving voltage	
14	P	VPH	VPH driving voltage	
15	P	VSH	Positive Source driving voltage	
16	P	VSH_LV	Positive Source driving voltage	
17	P	VSH_LV2	Positive Source driving voltage	
18	P	VSL	Negative Source driving voltage	
19	P	VSL_LV	Negative Source driving voltage	
20	P	VSL_LV2	Negative Source driving voltage	
21	P	GNDA	Ground ; Connect to GND	
22		REFN	Reserved	
23		REFP	Reserved	
24	O	TSCL	I2C Interface to digital temperature sensor Clock pin	
25	I/O	TSDA	I2C Interface to digital temperature sensor Data pin	
26	I	BS0	Bus selection pin; L: 4-wire IF. H: 3-wire IF. (Default)	
27	I	BS1	Bus selection pin; L: refer to BS0. (Default) H: Standard 4-wire SPI/dual SPI/quad SPI	
28	I	RES#	Reset	
29	O	BUSY_N	Busy state output pin	
30	I	D/C#	Data /Command control pin (D/C)	
31	I	CS#	Chip Select input pin (CSB)	
32	I	SCL	Serial clock pin (SPI)	
33	I/O	SI0	serial data pin (SPI)	
34	I/O	SI1	serial data pin ; Reserved	
35	I/O	SI2	serial data pin ; Reserved	
36	I/O	SI3	serial data pin ; Reserved	
37	P	VDDDO	Core logic power pin; Connect to VDDD	
38	P	VDD	Supply voltage	
39	P	GND	Ground; Connect to GNDA	



40	P	VDDIO	Supply voltage	
41	P	VCP2	Charge Pump Pin	
42	P	CP2N	Charge Pump Pin	
43	P	CP2P	Charge Pump Pin	
44	P	VCP1	Charge Pump Pin	
45	P	CP1N	Charge Pump Pin	
46	P	CP1P	Charge Pump Pin	
47		CGH1N	Charge Pump Pin; Reserved	
48		CGH1P	Charge Pump Pin; Reserved	
49	P	VGH	Positive Gate driving voltage	
50	P	VCOMBD	VCOMBD driving voltage	

Note 5-1: 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 5-2: 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 5-3: This pin (RES#) is reset signal input. The Reset is active Low.

Note 5-4: This pin (BUSY\_N) 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
- Programming with OTP
- Communicating with digital temperature sensor

Note 5-5: This pin (BS0) 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. Please refer to below Table.

**Table: Bus interfaceselection**

BS1	MPU Interface
L	4-lines serial peripheral interface (SPI)
H	3-lines serial peripheral interface (SPI) – 9 bits SPI

## 6. Electrical Characteristics

### 6.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Logic Supply Voltage	VDD	-0.5	+3.6	V
Tst	Storage Temperature	-25	65	°C
Top	Operating Temperature	0	50	°C

Note 6-1: Maximum ratings are those values beyond which damages to the device may occur.

Note 6-2: Functional operation should be restricted to the limits by chapter "6. Electrical Characteristics".

## 6.2 Panel DC characteristics

The following specifications apply for: VDD = 3.3V, TA = 25 °C

DIGITAL DC CHARACTERISTICS						
Symbol	Parameter	Conditions	MIN.	TYP.	Max	Unit
VDD	Logic supply voltage		2.4	3.0	3.6	V
VGH	Positive Gate driving voltage		19.0	20.0	21.0	V
VGL	Negative Gate driving voltage		-21.0	-20.0	-19.0	V
VSH	Positive source driving voltage		14.5	15.0	15.5	V
VSL	Negative source driving voltage		-15.5	-15.0	-14.5	V
VCOM_DC	VCOM_DC output voltage		-4.0	Adjusted	-0.3	V
VCOM_AC	VCOM_AC output voltage		VSL+ VCOM_DC	--	VSH+ VCOM_DC	V
VIL	Low level input voltage	Digital input pins	0	--	0.2xVDD	V
VIH	High level input voltage	Digital input pins	0.8xVDD	--	VDD	V
VOH	High level output voltage	Digital input pins, IOH= 8 mA	0.8xVDD	--	--	V
VOL	Low level output voltage	Digital input pins, IOL= 8 mA	0	--	0.2xVDD	V
IMSTB	Module stand-by current	Stand-by Mode	--	TBD	--	uA
IMDS	Module deep sleep current	Deep sleep Mode	--	TBD	--	uA
Inc	Inrush Current	High loading pattern	--	TBD	TBD	mA
IMOPR	Module operating current	TYP loading pattern	--	TBD	TBD	mA
		High loading pattern		TBD	TBD	
P	Operation Power Dissipation	TYP loading pattern VDD=3.3V with DC-DC	--	TBD	TBD	mW
		High loading pattern VDD=3.3V with DC-DC		TBD	TBD	
PSTBY	Standby Power Dissipation	VDD=3.3V	--	TBD	--	uW



Note 6-3: The module operating current data is measured by using oscilloscope, and extract the mean value.

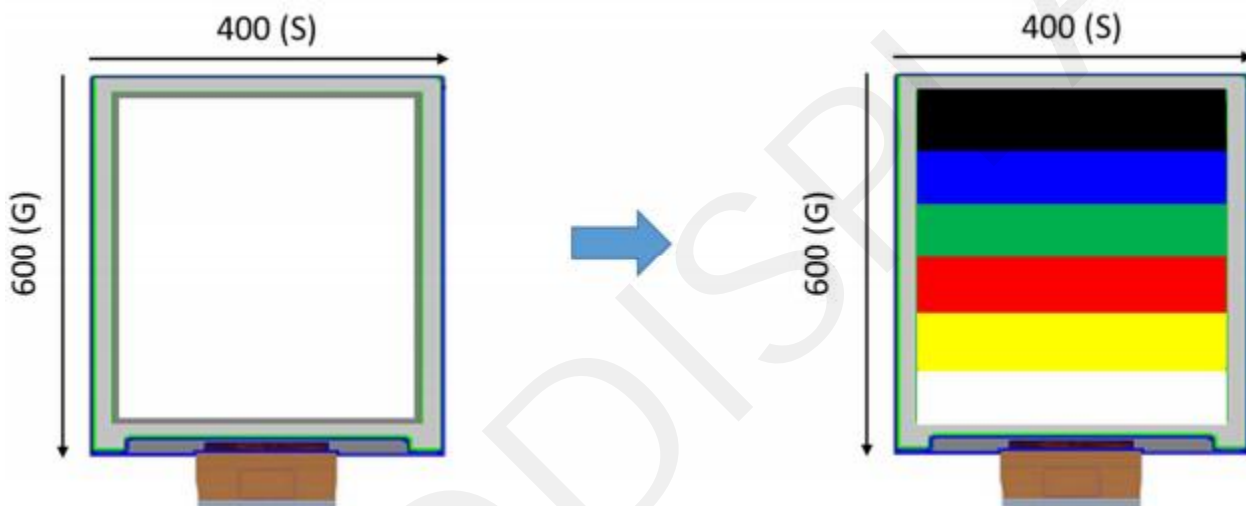
Note 6-4: The typical power consumption is measured using associated 25C waveform with following pattern transition: from full white pattern to color stripe pattern. (Note 6-8)

Note 6-5: The high loading (Max) power consumption is measured using associated 25C waveform with following pattern transition: from full white pattern to noise pattern (including random scattering of 6 colors).(Note 6-9)

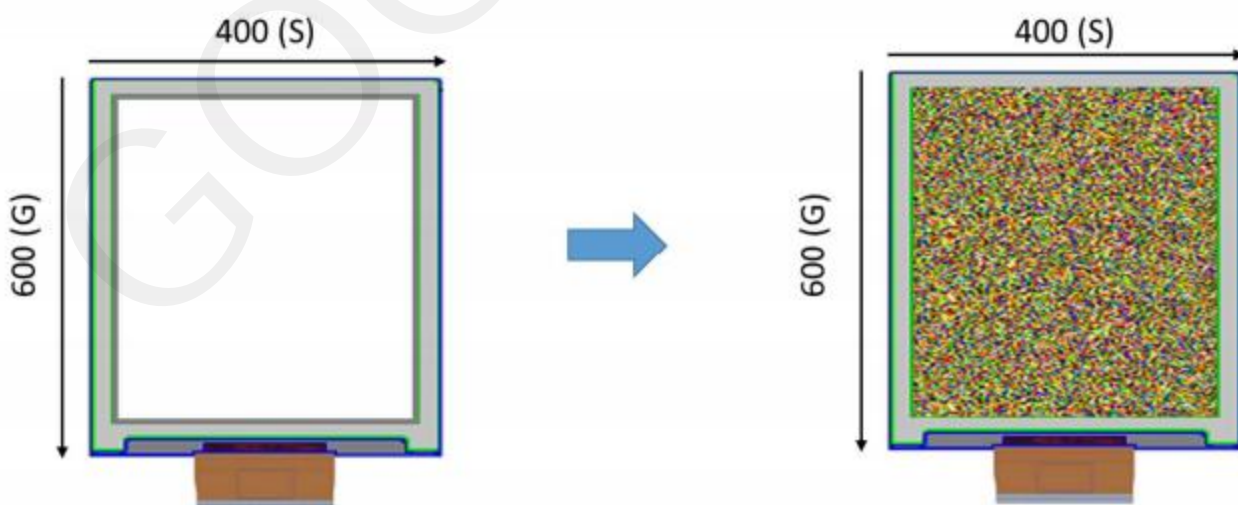
Note 6-6: The listed electrical/optical characteristics are only guaranteed under the controller & waveform provided by E Ink.

Note 6-7: Vcom value has been set in the IC on the panel.

Note 6-8: The typical power consumption



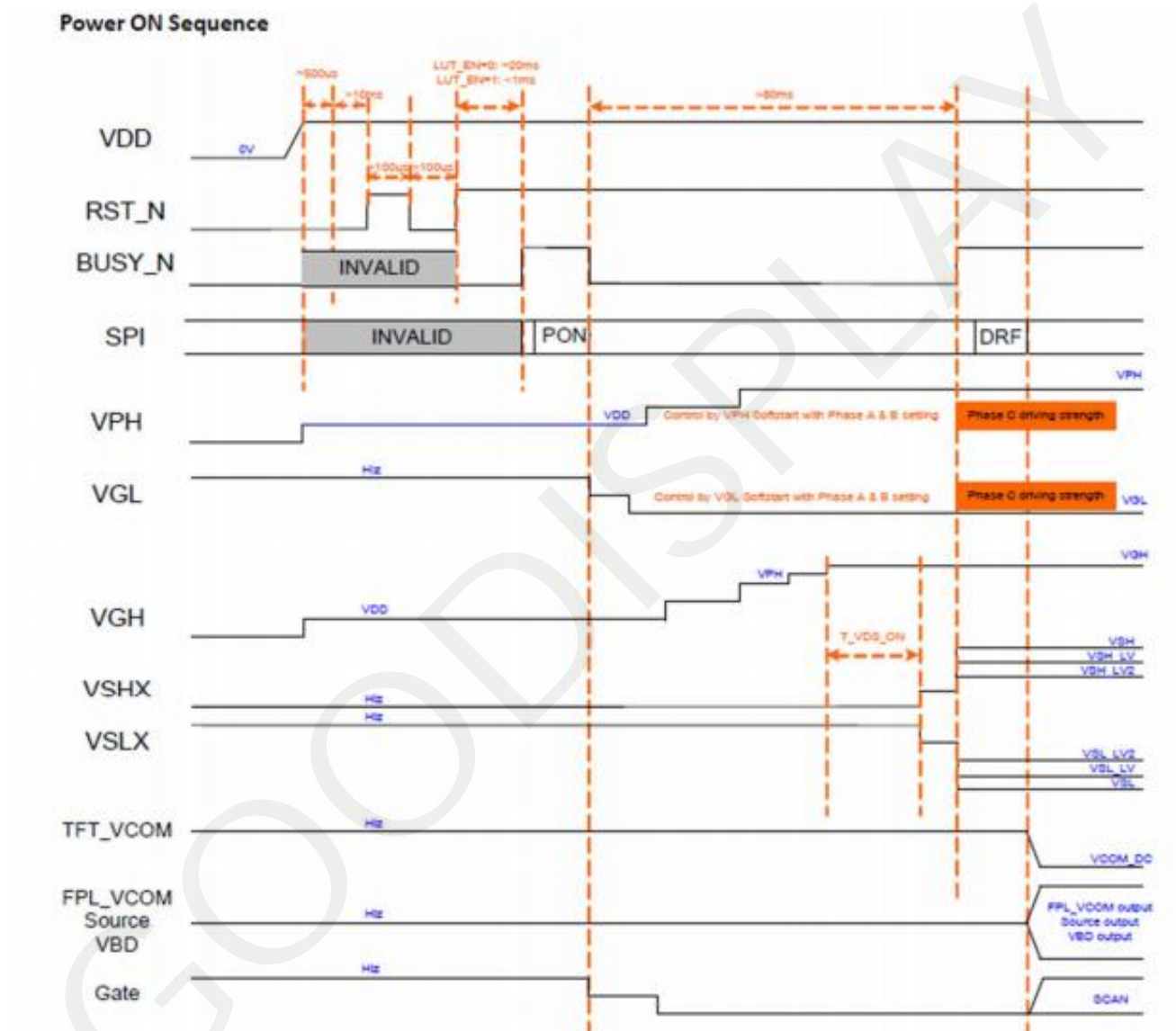
Note 6-9: The high loading power consumption



## 7. Power Sequence

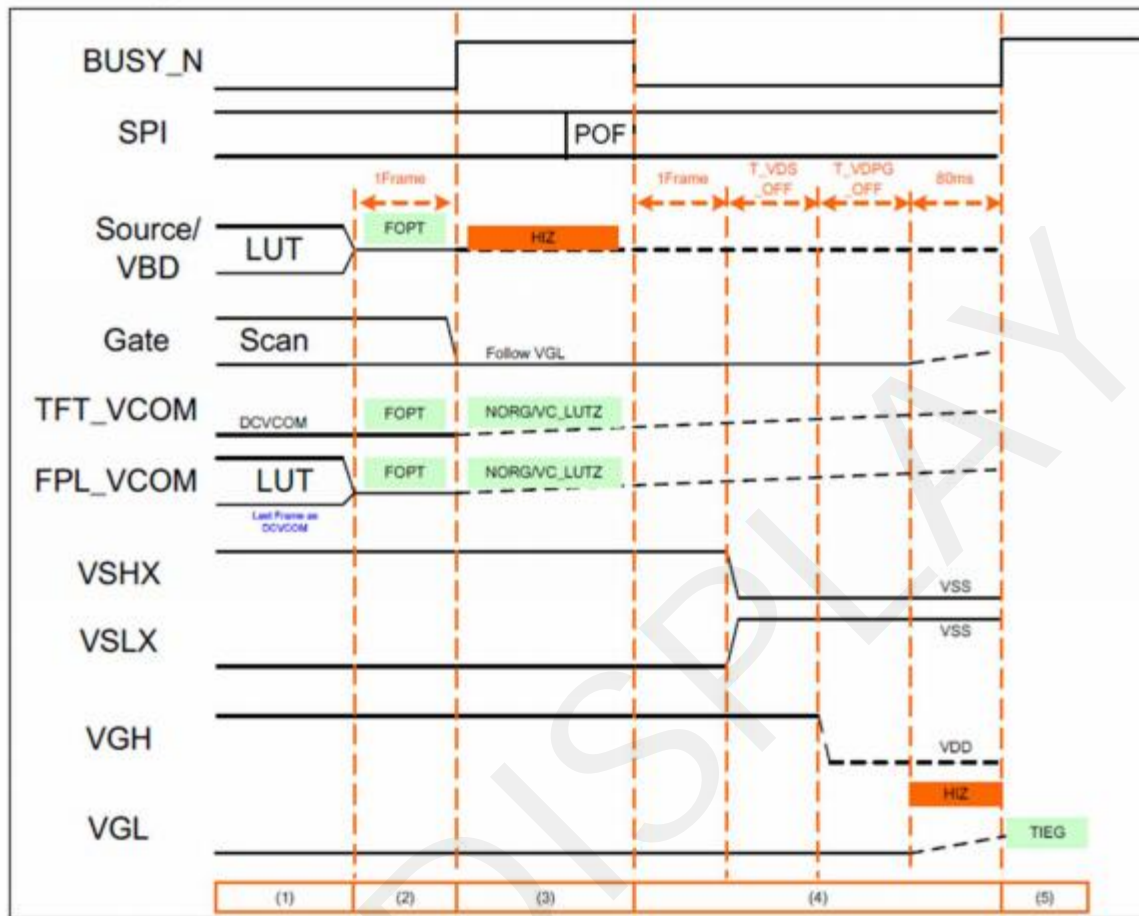
In order to prevent IC fail in power on resetting, the power sequence must be followed as below.

### 7.1 Power on Sequence Display



## 7.2 Power off Sequence Display

Power OFF Sequence



Power OFF sequence:

## 8. Optical characteristics

### 8.1 Specification

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

Item	PARAMETER	Test Condition	Spec			
Optical Characteristics Evaluation	Color Performance (CIELAB)		L*	a*	b*	dE2000
		Black	TBD	TBD	TBD	TBD
		White	TBD	TBD	TBD	TBD
		Blue	TBD	TBD	TBD	TBD
		Green	TBD	TBD	TBD	TBD
		Red	TBD	TBD	TBD	TBD
		Yellow	TBD	TBD	TBD	TBD

Note 8-1: Measuring Instrument: Minolta CM-25cG

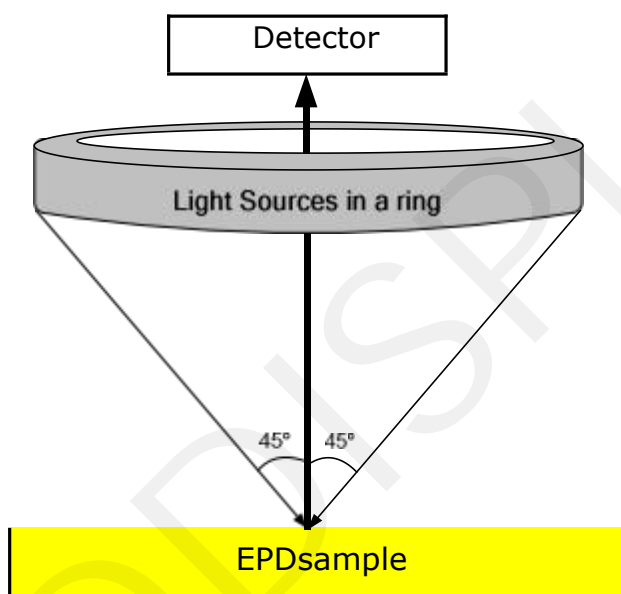
Note 8-2: Performance values at 24°C ambient

Note 8-3: All items on this version is only for reference. The final item will be based on the real measurement result.

## 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

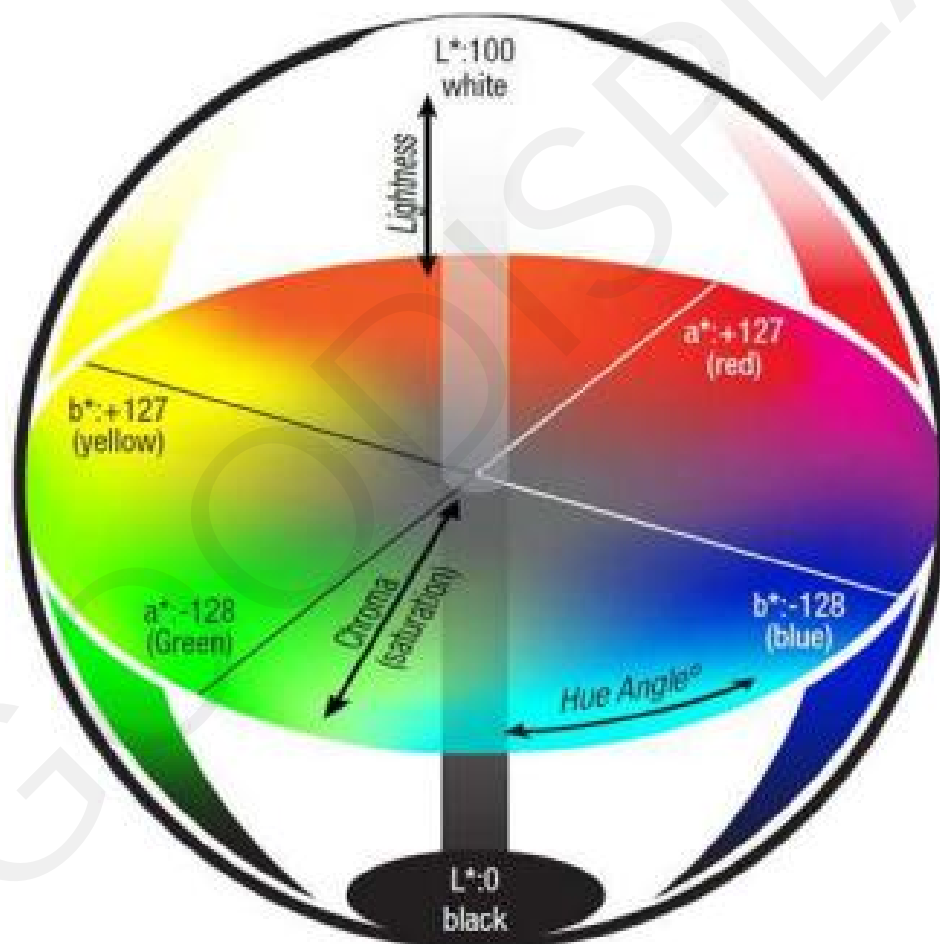
The reflection ratio is expressed as :

$$R = \text{Reflectance Factor whiteboard} \times (L_{\text{center}} / L_{\text{whiteboard}})$$

$L_{\text{center}}$  is the luminance measured at center in a white area ( $a^* \sim b^* \sim 0$ ).  $L_{\text{whiteboard}}$  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.

### 8.4 Definition of Color Performance & Saturation ratio

The Spectroradiometer Minolta CM-25cG was used to measure color image to obtain  $L^*$ ,  $a^*$ ,  $b^*$ . Collect  $L^*$ ,  $a^*$ ,  $b^*$  and then determine the color space.



## 9. Handling, Safety and Environmental Requirements

<b>WARNING</b>
<p>The display glass may break when it is dropped or bumped on a hard surface. Handle with care.</p> <p>Should the display break, do not touch the electrophoretic material. In case of contact with electrophoretic material, wash with water and soap.</p>

<b>CAUTION</b>
<p>The display module should not be exposed to harmful gases, such as acid and alkali gases, which corrode electronic components.</p>
<p>Disassembling the display module can cause permanent damage and invalidate the warranty agreements.</p>

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.

<b>Data sheet status</b>	
Product specification	The data sheet contains final product specifications.
<b>Limiting values</b>	
<p>Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134).</p> <p>Stress above one or more of the limiting values may cause permanent damage to the device.</p> <p>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.</p>	
<b>Application information</b>	
<p>Where application information is given, it is advisory and does not form part of the specification.</p>	

<b>Product Environmental certification</b>
RoHS



## 10. Reliability test

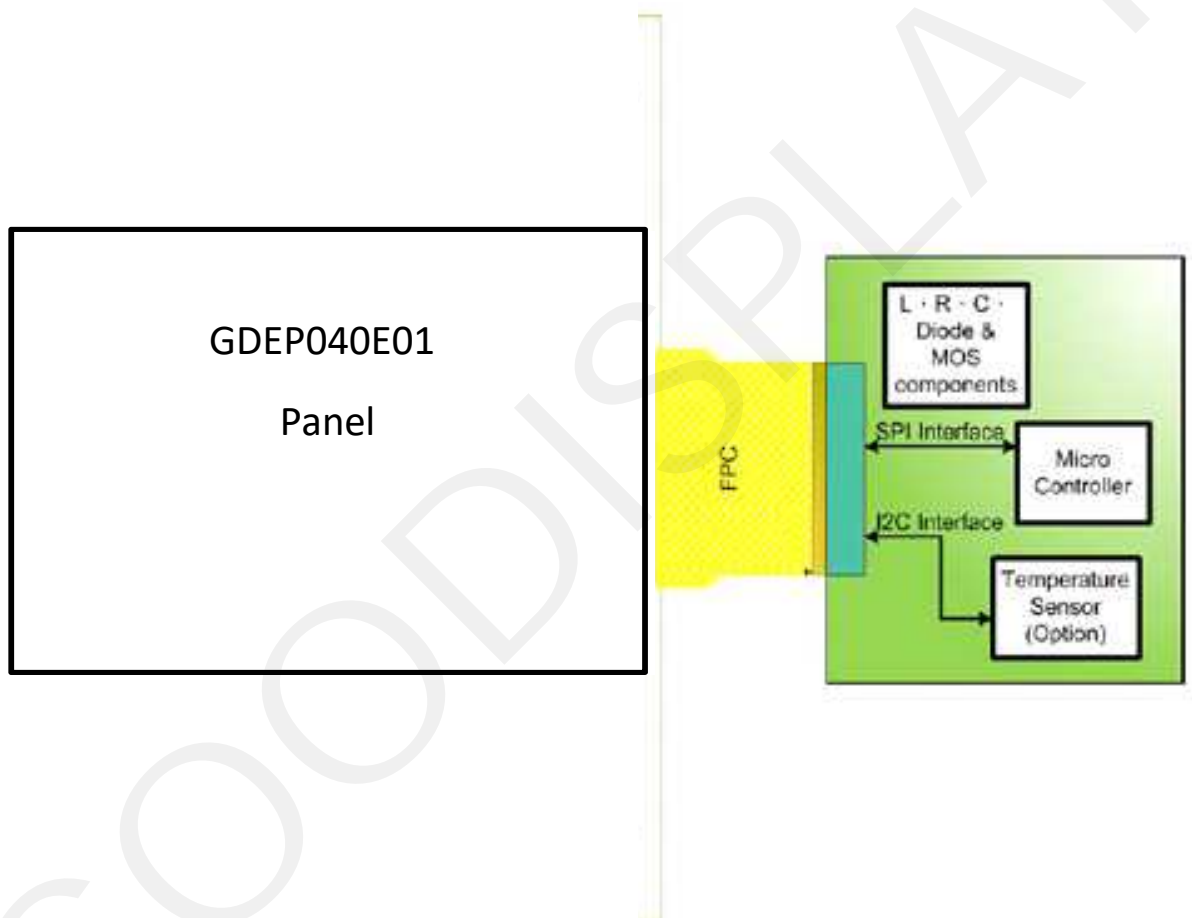
	TEST	CONDITION	METHOD	REMARK
1	High-Temperature Operation	T = +40°C, RH = 35% for 240 hrs	IEC 60 068-2-2Be	--
2	Low-Temperature Operation	T = 0°C for 240 hrs	IEC 60 068-2-1Ae	--
3	High-Temperature, High-Humidity Operation	T = +40°C, RH = 90% for 240 hrs	IEC 60 068-2-78	
4	Low-Temperature Storage	T = -25°C for 240 hrs (Test in white pattern)	IEC 60 068-2-1Ab	
5	High-Temperature High-Humidity Storage	T = +50°C, RH = 80% for 240hrs (Test in White Pattern)	IEC 60 068 2-3CA	
6	High-Temperature Storage	T = +60°C, RH = 40% for 240hrs (Test in White Pattern)	IEC 60 068-2-2Bb	--
7	Temperature Cycle	T = -25°C → +60°C, 50 Cycle 30min 30min (Test in white pattern)	IEC 068-2-14 Nb	--
8	Electrostatic Effect (non-operating)	(Machine model) ± 250 V 0Ω, 200pF	IEC 62179, IEC 62180	--

### [Criteria]

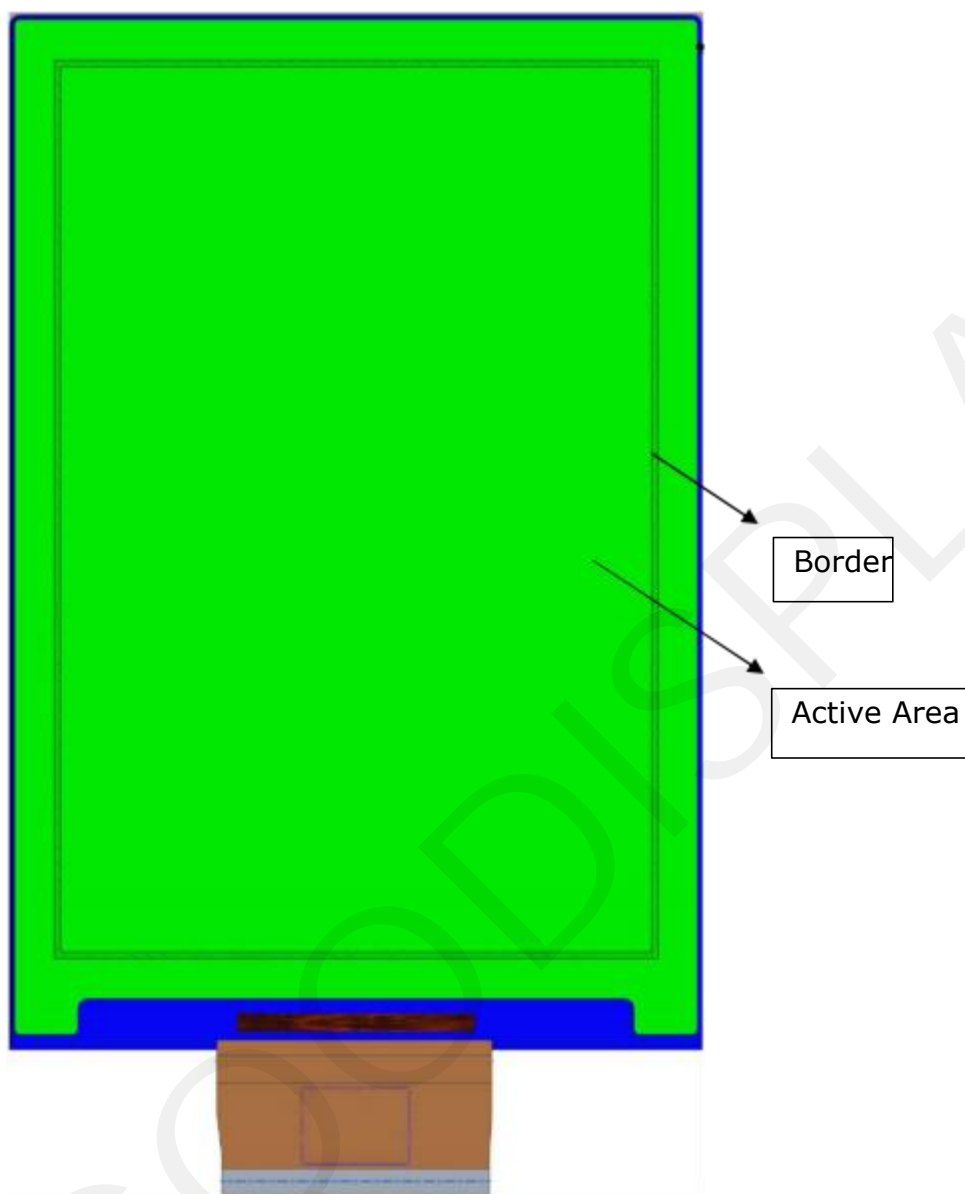
In the standard conditions, there is not display function NG issue occurred.  
(including: line defect ,no image).

All the cosmetic specification is judged before the reliability stress.

## 11. Block Diagram



## 12. Border definition



## 13. Matched Development Kit

Our Development Kit designed for SPI E-paper Display aims to help users to learn how to use E-paper Display more easily. It can refresh black-white E-paper Display, three-color (black, white and red/Yellow) E-paper Display and four-color (black, white, red and yellow) Good Display 's E-paper Display. And it is also added the functions of USB serial port, FLASH chip, font chip, current detection ect.

Development Kit consists of the development board and the pinboard.

Supported development platforms include STM32 and ESP32. More details, please click to the following links:

STM32 <https://www.good-display.com/product/219.html>

ESP32 <https://www.good-display.com/product/338.html>

## 14. Precautions

- (1) Do not apply pressure to the EPD panel in order to prevent damaging it.
- (2) Do not connect or disconnect the interface connector while the EPD panel is in operation.
- (3) Do not touch IC bonding area. It may scratch TFT lead or damage IC function.
- (4) Please be mindful of moisture to avoid its penetration into the EPD panel, which may cause damage during operation.
- (5) If the EPD Panel / Module is not refreshed every 24 hours, a phenomena known as "Ghosting" or "Image Sticking" may occur. It is recommended to refreshed the ESL /EPD Tag every 24 hours in use case. It is recommended that customer ships or stores the ESL / EPD Tag with a completely white image to avoid this issue
- (6) High temperature, high humidity, sunlight or fluorescent light may degrade the EPD panel's performance. Please do not expose the unprotected EPD panel to high temperature, high humidity, sunlight, or fluorescent for long periods of time.
- (7) For more precautions, please click on the link:  
<https://www.good-display.com/news/80.html>