3.1 inch
E-paper Display Series

GDEQ031T10

Dalian Good Display Co., Ltd.

GooDisplay®

Product Specifications

Customer	**Standard**
Description	3.1**” E-PAPER DISPLAY**
Model Name	**GDEQ031T10**
Date	**2022/03/08**
Revision	**1.0**

	Design Engineering		
	Approval	**Check**	**Design**
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Version	Content	Date	Producer
1.0	New release	2022/03/08	

1. General Description

1.1 Overview

GDEQ031T10 is a reflective electrophoretic display module on an active matrix TFT substrate, The diagonal length of the active area is 3.1" and contains 240x320 pixels. The panelis capable of displaying 1-bit black,and white images depending on the associated lookup tableused. The circuitry on the panel includes an integrated gate and source driver, timing controller,oscillator, DC-DC boost circuit, and memory to store the frame buffer and lookup tables, andadditional circuitry to control VCOM and border settings.

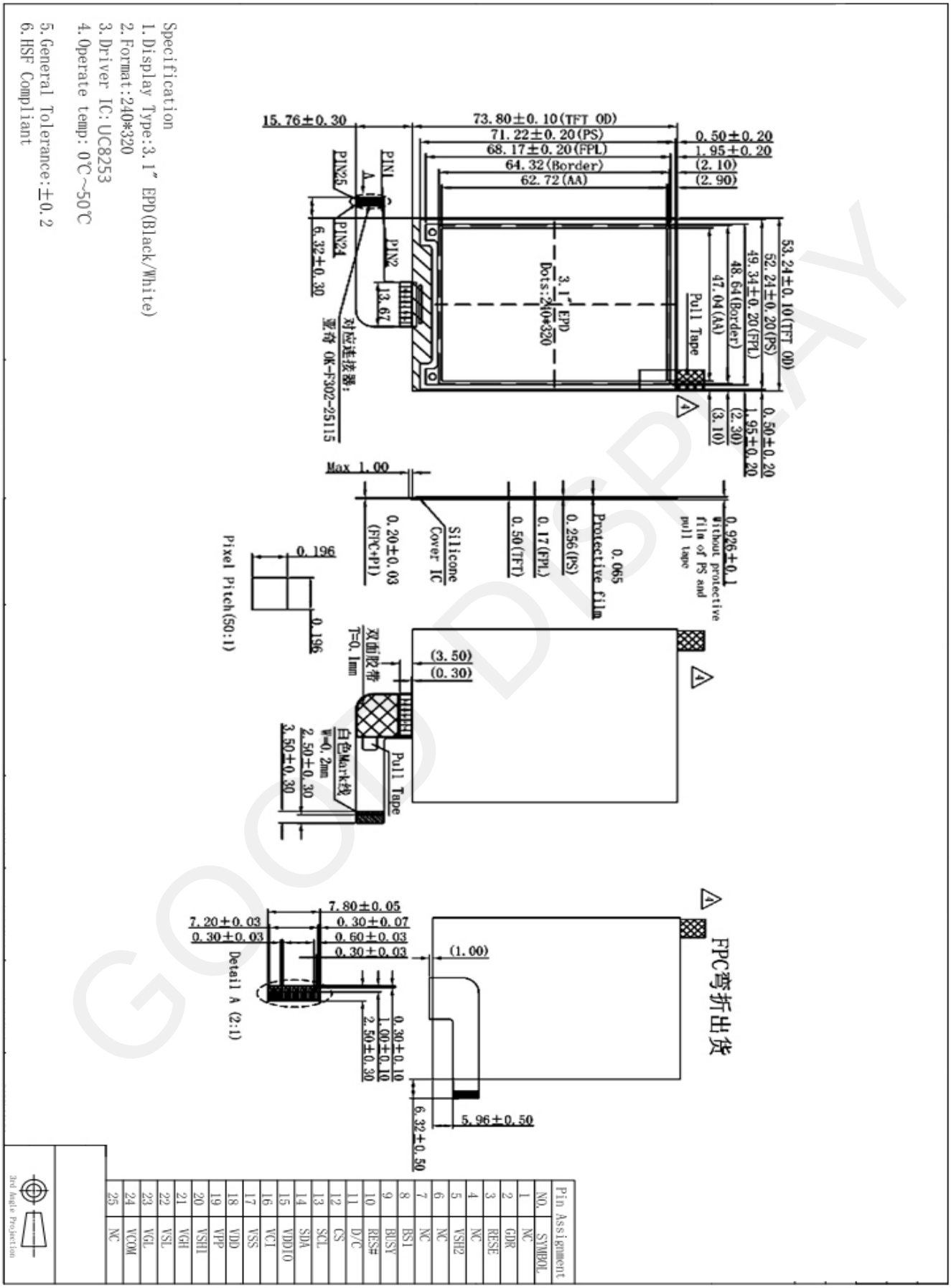
1.2 Features

- Ultra wide viewing angle
- Ultra low power consumption
- I2C Signal Master Interface to read external temperature sensor.
- On chip display RAM
- Interface:4-Wire SPI or 3-Wire SPI
- Wide range of operating temperature: 0℃to 50℃
- Wide range of storage temperature: -25℃ to 60℃
- High reflectance and contrast TFT electrophoretic.

1.3 Mechanical Specifications

NO.	ITEM	SPECIFICATION	UNIT
1	Type	Dot Matrix	-
2	Screen Size	3.1	Inch
3	Active Area	62.72(H) ×47.04(V)	mm
4	Pixel Pitch	0.196×0.196	mm
5	Pixels Per Inch	129	-
6	Outline Dimension	73.8 x 53.24 x 0.926	mm
7	Resolution	320(V) ×240(H)	-
8	Pixel Configuration	Rectangular	-
9	Driver IC	UC8253	-
10	Module Weight	7.33±10%	gram

1.4 Mechanical Drawing of EPD module



1.5 Module Interface

PIN NO.	PIN NAME	DESCRIPTION
1、4	NC	No Connection
2	GDR	This pin is N-Channel MOSFET gate drive control pin.
3	RESE	Current Sense Input for the control loop
5	VSH2	This pin is Positive Source driving voltage,VSH2 Connect a stabilizing capacitor between VSH2 and VSS in the application circuit.
6、7	NC	No Connection
8	BS1	This pin is for selecting 3-wire(H active) or 4-wire(L active) SPI interface.
9	BUSY	Driver busy flag.
10	RES#	This pin is reset signal input (Active Low).
11	D/C	This pin is Data/Command control pin connecting to the MCU
12	CS	This pin is the chip select input connecting to the MCU.
13	SCL	This pin is serial clock pin for interface.
14	SDA	This pin is serial data pin for interface.
15	VDDIO	Power input pin for the Interface.
16	VCI	Power input pin for the chip.
17	VSS	Ground
18	VDD	Core logic power pin VDD.
19	VPP	Power Supply for OTP Programming
20	VSH1	This pin is Positive Source driving voltage,VSH1 Connect a stabilizing capacitor between VSH1 and VSS in the application circuit.
21	VGH	This pin is Positive Gate driving voltage.Connect a stabilizing capacitor between VGH and VSS in the application circuit.
22	VSL	Negative Source driving voltage
23	VGL	This pin is Negative Gate driving voltage.
24	VCOM	VCOM driving voltage
25	NC	No Connection

1.6 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 and three-color (black, white and red/Yellow) Good Display ‘s E-paper Display. And it is also added the functions of USB serial port, Raspberry Pi and LED indicator light ect.

DESPI Development Kit consists of the development board and the pinboard. More details about the Development Kit, please click to the following link:

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

2. Environmental

2.1 HANDLING, SAFETY AND ENVIROMENTAL REQUIREMENTS

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.

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.

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.	
Product specification	The data sheet contains final 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 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 dose not form part of the specification.

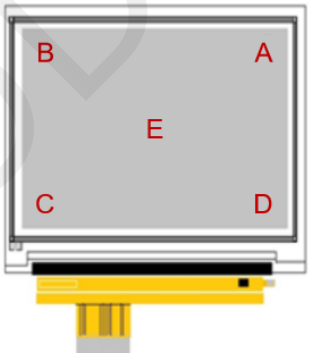
Product Environmental certification
ROHS

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.

2.2 Reliability test

NO	Test items	Test condition	QUANTITY
1	Low-Temperature Storage	T = -25℃ , low temperature film T= -30℃; White screen state, for 240h.	5pcs
2	Low-Temperature Operation	T = 0°C, 240 h; Put the product into the experimental procedure, run it in the temperature box, and check it every 24 hours.	5pcs
3	High-Temperature Operation	T = 50°C, RH = 35%, 240 h; Put the product into the experimental procedure, run it in the temperature box, and check it every 24 hours.	5pcs
4	High-Temperature Storage	T=60ºC，RH=35%; White screen state, for 240h.	5pcs
5	Temperature Cycle	1 cycle:[-25°C 30min]→[+60 °C 30 min]; 100 cycles.	5pcs
6	High-Temperature/ High- humidity Storage	T=60ºC，RH=90%; White screen state, for 240h.	5pcs
7	UV exposure Resistance	765W/m²for 168hrs,T = 40°C, RH=35%;	5pcs
8	ESD Contact discharge	±200V, Test 5 point; Each point discharge 10 times. Time interval is not less than 1 second.	5pcs

ESD test location



Test and measurement conditions

After the end of the experiment, the sample was taken out of the temperature chamber, and stood at room temperature for 1h, and then the sample was inspected for appearance, function and optical inspection.

Criteria for qualification (pass the test if all qualified) :

(1) The product can be normal refresh.

(2) There are no new point defects or line defects in the display screen.

(3) No discoloration, blurred handwriting and barcode can be read on the complex screen.

3. ELECTRICAL CHARACTERISTICS

3.1 ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN	MAX	UNIT	REMARK
Logic supply voltage	VCI/VDD	-0.3	+6.0	V	-
I/O supply voltage	VDDIO	-0.3	+6.0		
OTP Program voltage	VPP	-0.3	+8.5	V	-
Logic Input voltage	VIN	-0.3	VDDIO+0.3	V	-
Operating Temp.	Top	0	+50	℃	-
Storage Temp	Tstg	-25	+60	℃	-

Note (1): All of the voltages are on the basis of "VSS = 0V".
Note (2): Maximum ratings are those values beyond which damages to the device may occur. Functional operation should be restricted to the limits in the Panel DC Characteristics tables.

3.2 DC Characteristics

The following specifications apply for: VSS=0V, VCI=3.3V, TOPR =25ºC.

Parameter	Symbol	Condition	Applicable pin	Min.	Typ.	Max.	Unit
IO supply voltage	VDDIO	-		2.3	3.3	3.6	V
Supply voltage	VDD	-		2.3	3.3	3.6	V
DCDC driver supply	VDDA			2.3	3.3	3.6	V
OTP program voltage	VPP			8.0	8.25	8.5	V
High level input voltage	V_{IH}	Digital input pins	-	0.7*VDDIO	-	VDDIO	V
Low level input voltage	V_{IL}	Digital input pins	-	0	-	0.3*VDDIO	V
High level output voltage	V_{OH}	I_{OH} = 400uA	-	VDDIO-0.4	-	-	V
Low level output voltage	V_{OL}	I_{OL} = -400uA	-	0	-	0.4	V
Input leakage current	I_{IN}	Digital input pins except pull-up, pull-down pin		-1		1	uA
Typical operating current(white state)	Iopr_VCI	-	-	-	8	-	mA
Typical power panel	P_{TYP}	-	-	-	11		mW
Full update time	-	25 °C	-	-	3	-	sec
Fast update time	-	25 °C	-	-	1	-	sec
Partial update time	-	25 °C	-	-	0.4	-	sec
Sleep mode current	Islp_VCI	VCI=3.3V DC/DC OFF No clock No output load Ram data retain	VCI	-	40	-	uA
Deep sleep mode current	Idslp_VCI	VDDD OFF	VCI	-	1	5	uA

Note: The VPP, VCI, VDDIO input must be kept in a stable value; ripple and noise are not allowed.

Notes:
1) Refresh time: the time it takes for the whole process from the screen change to the screen stabilization.
2) The difference between different refresh methods:
Full refresh: The screen will flicker several times during the refresh process;
Fast Refresh: The screen will flash once during the refresh process;
Partial refresh: The screen does not flicker during the refresh process.

Note: During the fast refresh or partial refresh of the electronic paper, it is recommended to add a full-screen refresh after 5 consecutive operations to reduce the accumulation of afterimages on the screen.

3.3 Panel DC Characteristics (Driver IC Internal Regulators)

The following specifications apply for: VSS=0V, VCI=3.3V, TOPR =25ºC.

Parameter	Symbol	Condition	Applicable pin	Min.	Typ.	Max.	Unit
VCOM output voltage	VCOM	-	VCOM	-	-2.0	-	V
Positive Source output voltage	VSH	-	S0~S239	-	+16	-	V
Negative Source output voltage	VSL	-	S0~S239	-	-16	-	V
Positive gate output voltage	Vgh	-	G0~G319	-0.3	-	22	V
Negative gate output voltage	Vgl	-	G0~G319	-22	-	0.3	V

3.4 Optical Specification

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

Symbol	Parameter	Conditions	Min	Typ.	Max	Units	Notes
R	White Reflectivity	White	-	36.55	-	%	Note 1
CR	Contrast Ratio	indoor	-	15.75	-	-	Note 2
T update	Image update time	25 ℃	-	3	-	sec	
Tlife	Life	Topr	-	1000000 times or 5years	-	-	-

Notes1: Luminance meter: Eye-One Pro Spectrophotometer.
Notes2:CR=Surface Reflectance with all white pixel/Surface Reflectance with all black pixels.

3.5 AC Electrical Characteristics

(1) Serial Peripheral Interface for 3-SPI

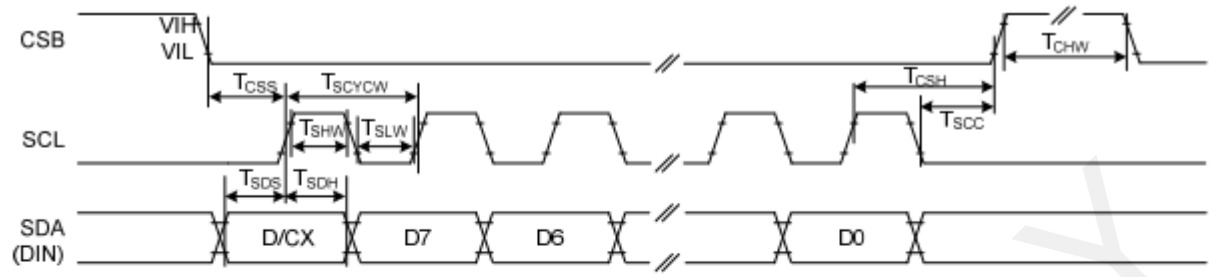


Figure: 3-wire Serial Interface Characteristics (Write mode)

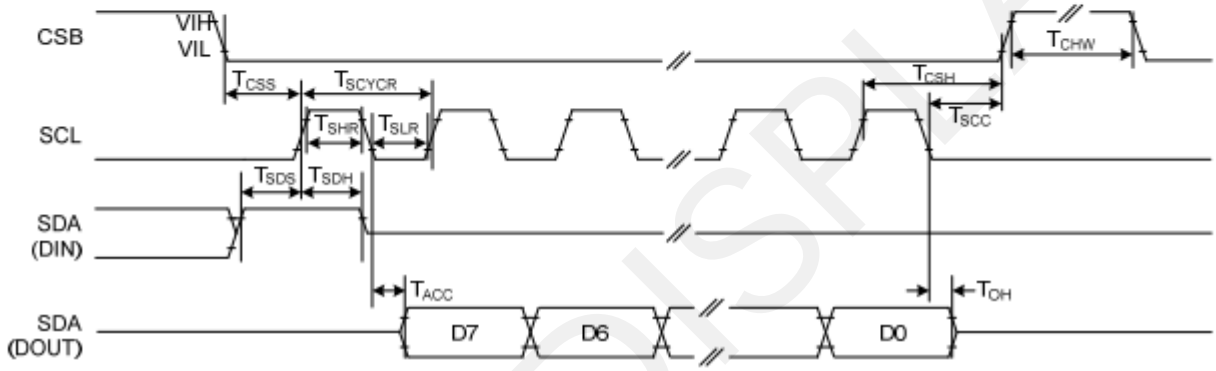


Figure: 3-wire Serial Interface Characteristics (Read mode)

Symbol	Signal / Parameter	Conditions	Min.	Typ.	Max.	Unit
T_{CSS}	CSB	Chip select setup time	60			ns
T_{CSH}		Chip select hold time	65			ns
T_{SCC}		Chip select setup time	20			ns
T_{CHW}		Chip select setup time	40			ns
T_{SCYCW}	SCL	Serial clock cycle (Write)	100			ns
T_{SHW}		SCL "H" pulse width (Write)	35			ns
T_{SLW}		SCL "L" pulse width (Write)	35			ns
T_{SCYCR}		Serial clock cycle (Read)	150			ns
T_{SHR}		SCL "H" pulse width (Read)	60			ns
T_{SLR}		SCL "L" pulse width (Read)	60			ns
T_{SDS}	SDA (DIN)	Data setup time	30			ns
T_{SDH}		Data hold time	30			ns
T_{ACC}	SDA (DOUT)	Access time			50	ns
T_{OH}		Output disable time	15			ns

(2) Serial Peripheral Interface for 4-SPI

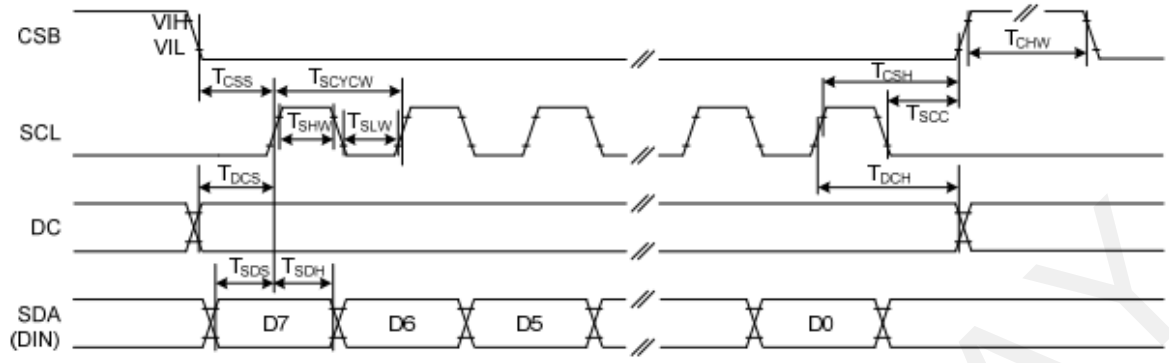


Figure: 4-wire Serial Interface Characteristics (Write mode)

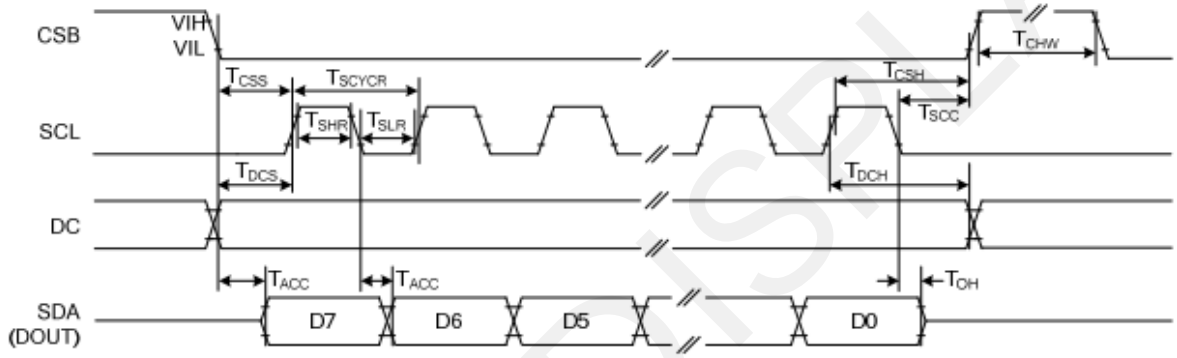


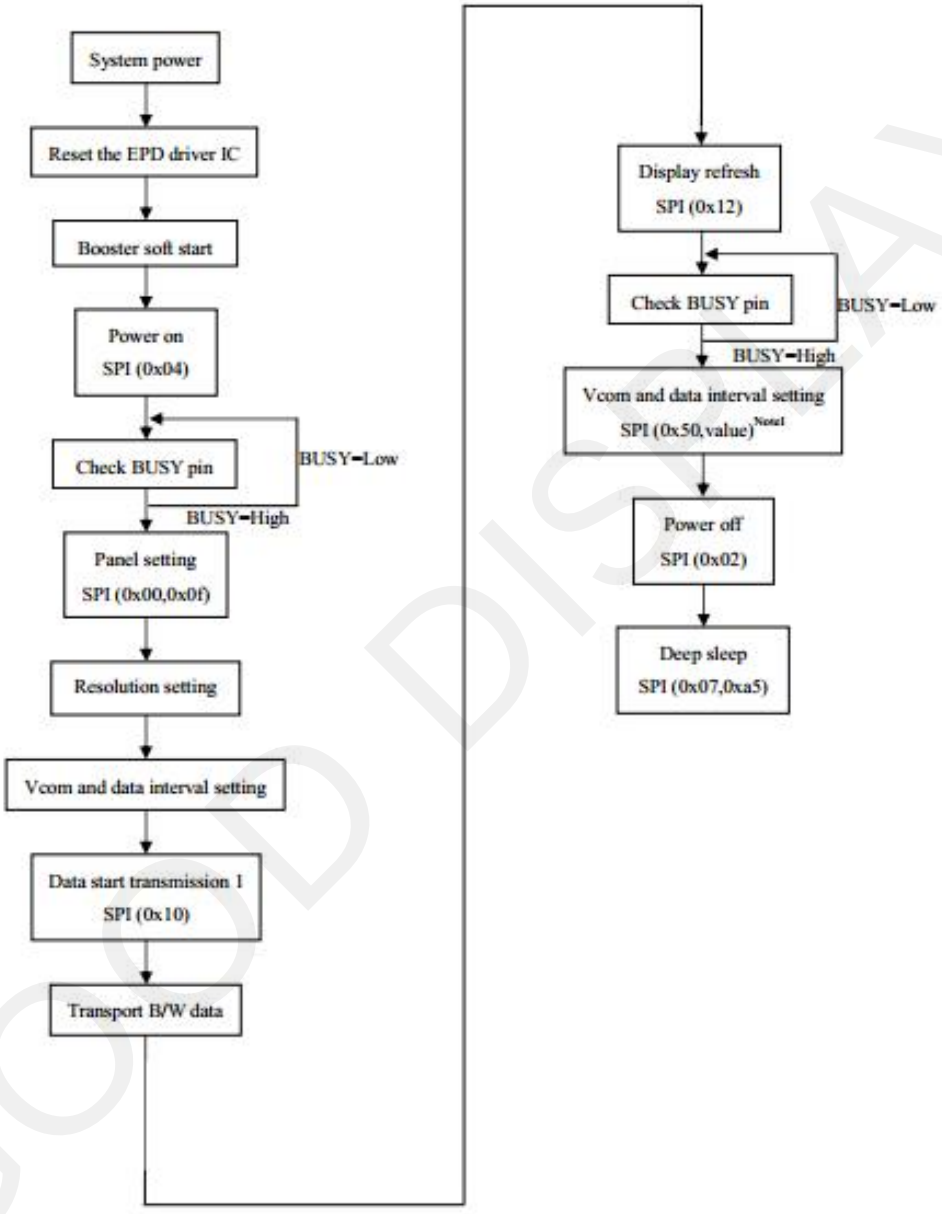
Figure: 4-wire Serial Interface Characteristics (Read mode)

Symbol	Signal / Parameter	Conditions	Min.	Typ.	Max.	Unit
T_{CSS}	CSB	Chip select setup time	60			ns
T_{CSH}		Chip select hold time	65			ns
T_{SCC}		Chip select setup time	20			ns
T_{CHW}		Chip select setup time	40			ns
T_{SCYCW}	SCL	Serial clock cycle (Write)	100			ns
T_{SHW}		SCL "H" pulse width (Write)	35			ns
T_{SLW}		SCL "L" pulse width (Write)	35			ns
T_{SCYCR}		Serial clock cycle (Read)	150			ns
T_{SHR}		SCL "H" pulse width (Read)	60			ns
T_{SLR}		SCL "L" pulse width (Read)	60			ns
T_{DCS}	DC	Data setup time	30			ns
T_{DCH}		Data hold time	30			ns
T_{SDS}	SDA (DIN)	Access time			50	ns
T_{SDH}		Output disable time	15			ns
T_{ACC}	SDA (DOUT)	Serial clock cycle (Read)	150			ns
T_{OH}		SCL "H" pulse width (Read)	60			ns

3.6 Functional Specification and Application Circuit

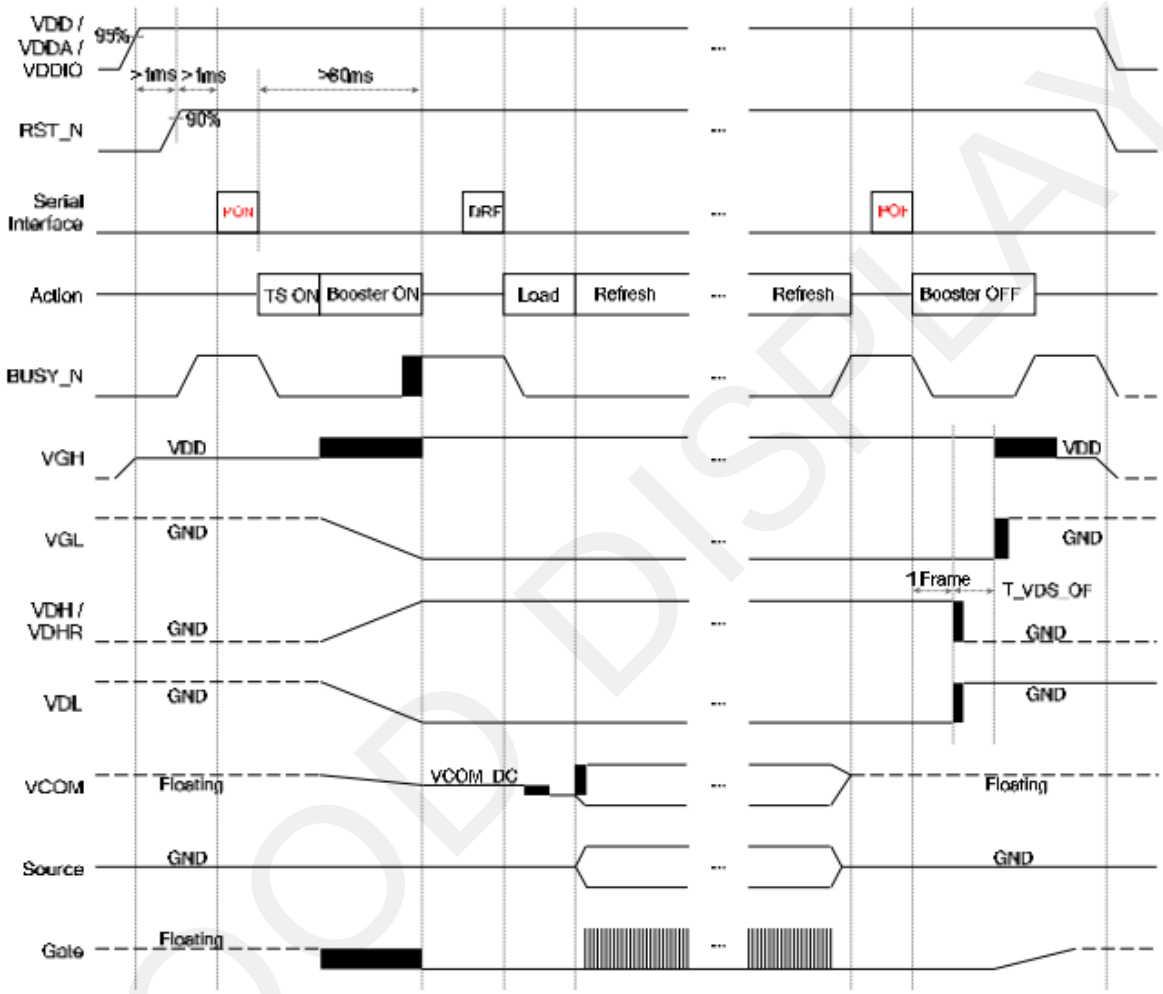
3.6.1 Operation Flow and Code Sequence

General operation flow to drive display panel



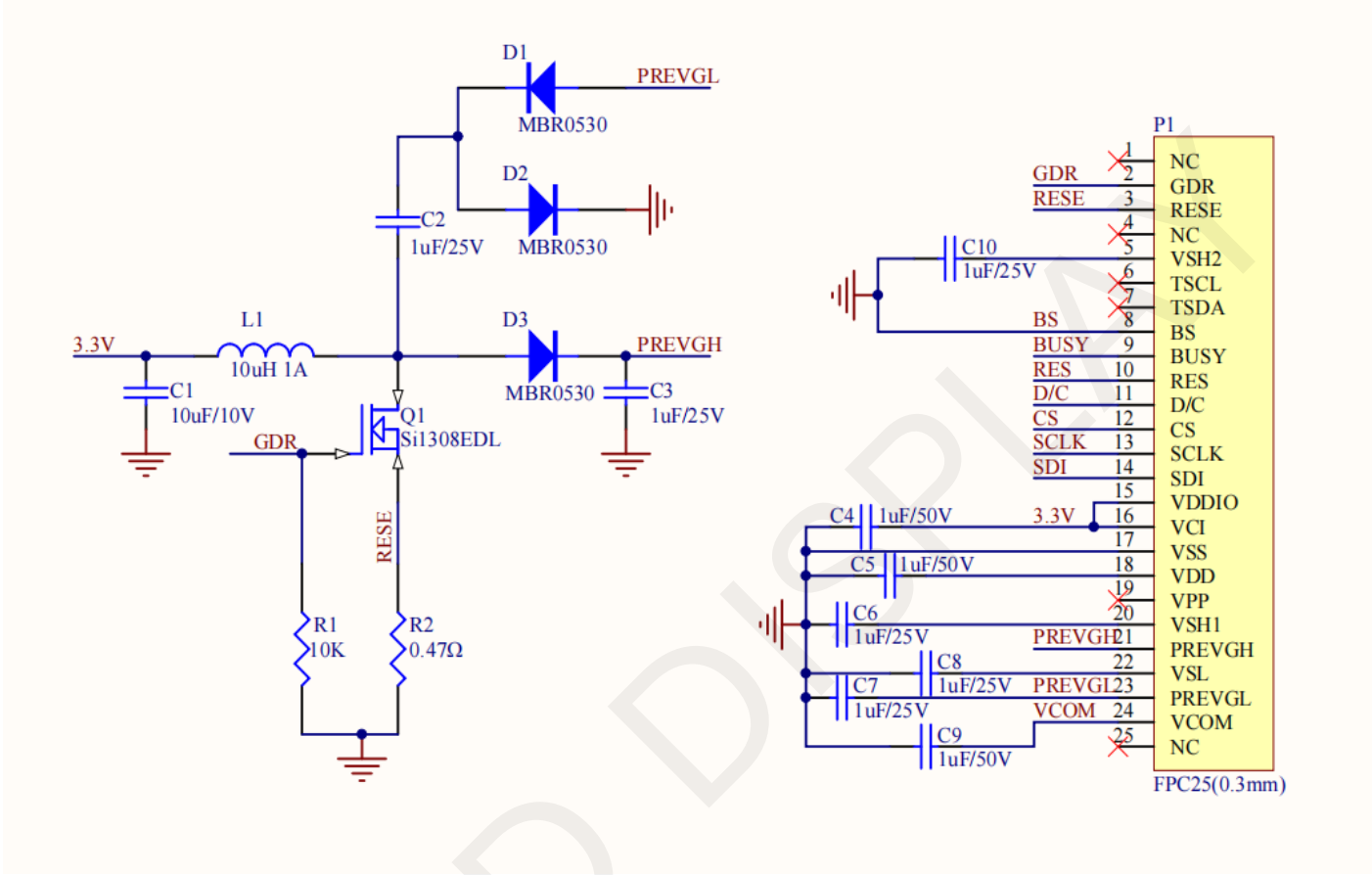
3.6.2 Power ON/Power OFF Sequence

1. Temperature sensor will be activated automatically for one-time sensing before enabling booster.
2. After refreshing display, VCOM will be set to floating automatically.
3. In OTP mode (REG=0), the LUT in OTP will be copied to register automatically after the DSP/DRF command.
4. After RST_N rising, the waiting time for internal initial processing, greater than 1mS, is necessary. Any commands transmitted to chip during this time will be ignored.



3.6.3 Typical Application Circuit with SPI Interface

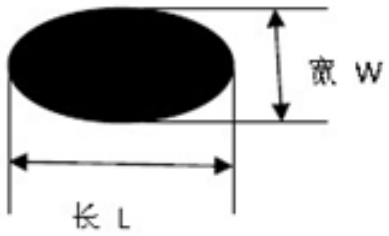
(1). Schematic of application circuit:



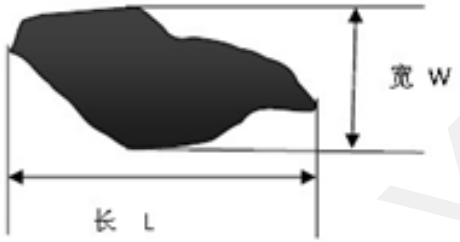
4. Inspection Standard

Defects Definition of Φ&L&W (Unit: mm)

4.1 Dot defects:

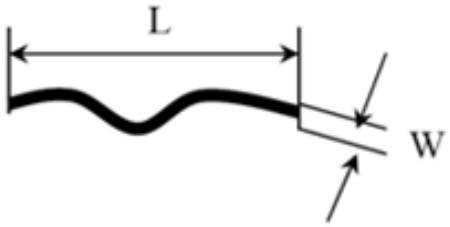


ΦD=Max(L,W)

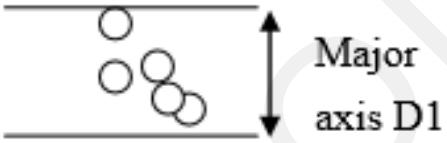


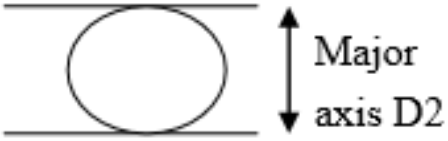
ΦD=Max(L,W)

4.2 line defect:



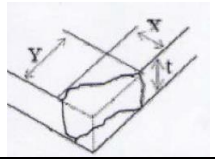
4.3 Small bubble aggregation and large bubble definition:





4.4 TFT warpage:

Appearance Defects

NO.	ITEM	CRITERIA	Acceptable range	Method	Defect level	Area
1	Dot defects (Black or White spot, Dirty spot, Foreign matter, Bubble)	D≦0.25mm	Ignore	Film Card	Minor	Zone A
		0.25mm < D≦0.5 mm, Distance≥5mm	N≦4			
		D>0.5 mm	N=0			
		0.1mm< D≦ 0.25 mm(Dense point)	N≦ 3/cm2			
2	Line defects (Foreign material, Scratch)	L≦ 2mm, W≦ 0.1mm	Ignore	Film Card	Minor	Zone A
		2mm<L≦ 8mm, 0.1<W≦ 0.5mm	N≦ 4			
		L>8mm, W>0.5mm (Note: FPL scratch is not allowed)	N=0			
	steel pit	Strip pits are not allowed	N=0	Sight Check	Major	Zone A
3	Glass Crack	Extensional cracks are not allowed 	N=0	Sight Check	Major	Zone B,C
4	Edge breakage	X≤3mm,Y≤0.5mm, It does not affect the electrode 	N≦2	Sight Check/ Microscope	Minor	Zone C
5	Chip Package Chip Off	X≤2mm · Y≤2mm, It does not affect the electrode(FPC edge) X≤1mm · Y≤1mm, It does not affect the electrode((Not FPC edge) 	N≦2	Sight Check/ Microscope	Minor	Zone C
6	Squalidity	No dirt (finger print, dust, residual glue, etc.)	Ignore	Sight Check	Minor	Zone A,B,C
7	Silicone	The maximum diameter of a single bubble cannot exceed 2mm	N≤2	Sight Check/ Film card	Minor	Zone C
		Crack is not allowed and there are no visible impurities in the glue of the lead part	N=0			

NO.	ITEM	CRITERIA	Acceptable range	Method	Defect level	Area
		The adhesive must completely cover the ACF, lead area and IC and should be applied evenly	N=0			
		No glue leakage, no obvious lack of glue in the lead area	N=0			
		Glue height exceeds PS surface	N=0			
		FPC Front overflow glue width>0.5mm or Back side overflow glue width>1mm	N=0			
8	Edge Sealing Adhesive	No glue leakage	N=0	Sight Check/ Film card	Major	Zone C
		The height of sealant exceeds PS surface	N=0		Minor	
		The edge sealing adhesive shall not leak TFT glass substrate	N=0			
		Water blocking area of PS edge sealing glue ≥ 0.7mm Determine OK	N=0		Minor	
9	Protective film	Foreign body in protective film	N=0	Sight Check	Minor	Zone A
		The protective film punctures and injures FPL	N=0			
10	Pull Tape	Attachment position is wrong Cannot tear up the protective film	N=0	Sight Check	Minor	Zone C
11	FPC	FPC has break, scratch, gold finger stripping or oxidation, dirty, residual glue	N=0	Sight Check	Major	Zone C
12	Glass edge bulge	X≤3mm · Y≤0.3mm	N≦1	Sight Check	Minor	Zone C
13	Warping	t＞1mm （3.5inch below） t＞3mm （3.5inch above）	N=0	Plug Gage	Minor	Zone C
14	Chromatism	Color difference in silver paste area (Not in Zone A)	Ignore	Sight Check	Minor	Zone C
		FPL Peeling occurs, chromatic aberration occurs	N=0	Sight Check	Major	Zone A
		FPL edge loss color difference in zone B ≥ 1 / 2 width	N=0	Sight Check	Major	Zone A,B
15	Silver pulp point	FPL and TFT substrate conduction, silver point <1.0mm(Single silver point and double silver point shall meet this specification）	N=0	Film card	Major	Zone C
16	Inkjet code	The inkjet font shall be clear and recognizable, and shall not be missing	N=0	Sight Check	Minor	Zone C

5. Packing

Controlled Seal

Packing Process(1)~(12)

(1) TRAY Type:
P310010-MT1-C

(2)

(3) order ①、②、①、②
fix trays with tape
384 pcs of 1 carton
1 tray contain 12 pcs
32 contained trays, 1 empty tray

(4) package with plastic bags
add five desiccants
create a power vacuum

(5) After tray be packed,
wrap the package in a
bubble bag and seal with
scoth tape.

(6)

(7) 32 contained trays, 1 empty
Package quantity products:
384 pcs of 1 carton.

Package finished

(8) Pallet stack
Pallet Type: 1100*1100*150mm
Plastic Pallet

一、The six carton is of one layer, maximum stack offive layers.
二、If the shipment is less than the full container, empty container shall be used to fill the current floor for shipmen.
三、Each carton layer should be centered on the pallet.

(9) Use paper edge protector
Top face paper edge protector type : P213010-MC4-A
Size: 1035*50*50mm,T=5mm
Side face paper edge protector type : P213010-MC5-A
Size: 1000*50*50mm,T=5mm

(10) Enwind stretch film
Wrap 3 layers of stretch film around the paper sheath (All around and on top),Wrap paper pallets, pallets, and boxes underneath

(11) Pack packing strap
The packing tape should be tied to the carton:
If Stack height greater than or equal to 3 layers, 2 turns in length, width and height;
If the stack height is less than 3 layers, the height direction is not used pack.

(12) Pack packing strap
The surface of the packing belt shall not be twisted, skewed or cracked; After the packaging is completed, the tightness of the packaging belt is suitable. Use the packing iron buckle to fix the belt and cut off the excess packaging belt. The remaining amount is less than or equal to 20mm

NOTE:1、The inner cartoster carton must be sealed with adhesive tape.
2、Fill up the gap with empty tray.
3、If the customer has special needs with the RoHS making, the inner carton and master carton need adhesive new RoHS marking at .
4、Packaging materials are not recommended for recycling.

6. 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