- Tentative Specification
- ✓ Preliminary Specification
- Specification Approval

Specification For SID 2.7” BWR EPD

Model Name: JS0270MN12-TNG-A0

Version:V0.1

SID	PREPARED BY	CHECKED BY	APPROVED BY
SIGNATURE	SH.Xie	Z.Nong	RJ.Wu
DATE	2023.08.17	2023.08.17	2023.08.17

	SIGNATURE	DATE
CUSTOMER APPROVAL		
	Notes:	

Notes :

1、Please contact SID before assigning your product based on this module specification.

2、To improve the quality of product, and this product specification is subject to change without any notice.

REVISION RECORD

Rev No.	Rev date	Contents	Remarks
0.1	20230817	First release	Preliminary

CONTENTS

1. General Description

SE0270MN12-TNG-A0 is an Active Matrix Electrophoretic Display (AMEPD), with interface and a reference system design. The2.7"active area contains 176×264 pixels, and has 1-bit B/W/R full display capabilities. An integrated circuit contains gate buffer, source buffer, interface, timing control logic, oscillator, DC-DC, SRAM, LUT, VCOM and border are supplied with each panel.

2. Features

- 176×264 pixels display
- High contrast
- High reflectance
- Ultra wide viewing angle
- Ultra low power consumption
- Pure reflective mode
- Bi-stable display
- Commercial temperature range
- Landscape, portrait modes
- Hard-coat antiglare display surface
- Ultra Low current deep sleep mode
- On chip display RAM
- Low voltage detect for supply voltage
- High voltage ready detect for driving voltage
- Internal temperature sensor
- 10-byte OTP space for module identification
- Waveform stored in On-chip OTP
- Serial peripheral interface available
- On-chip oscillator
- On-chip booster and regulator control for generating VCOM, Gate and Source driving voltage
- I2C signal master interface to read external temperature sensor/ built-in temperature sensor

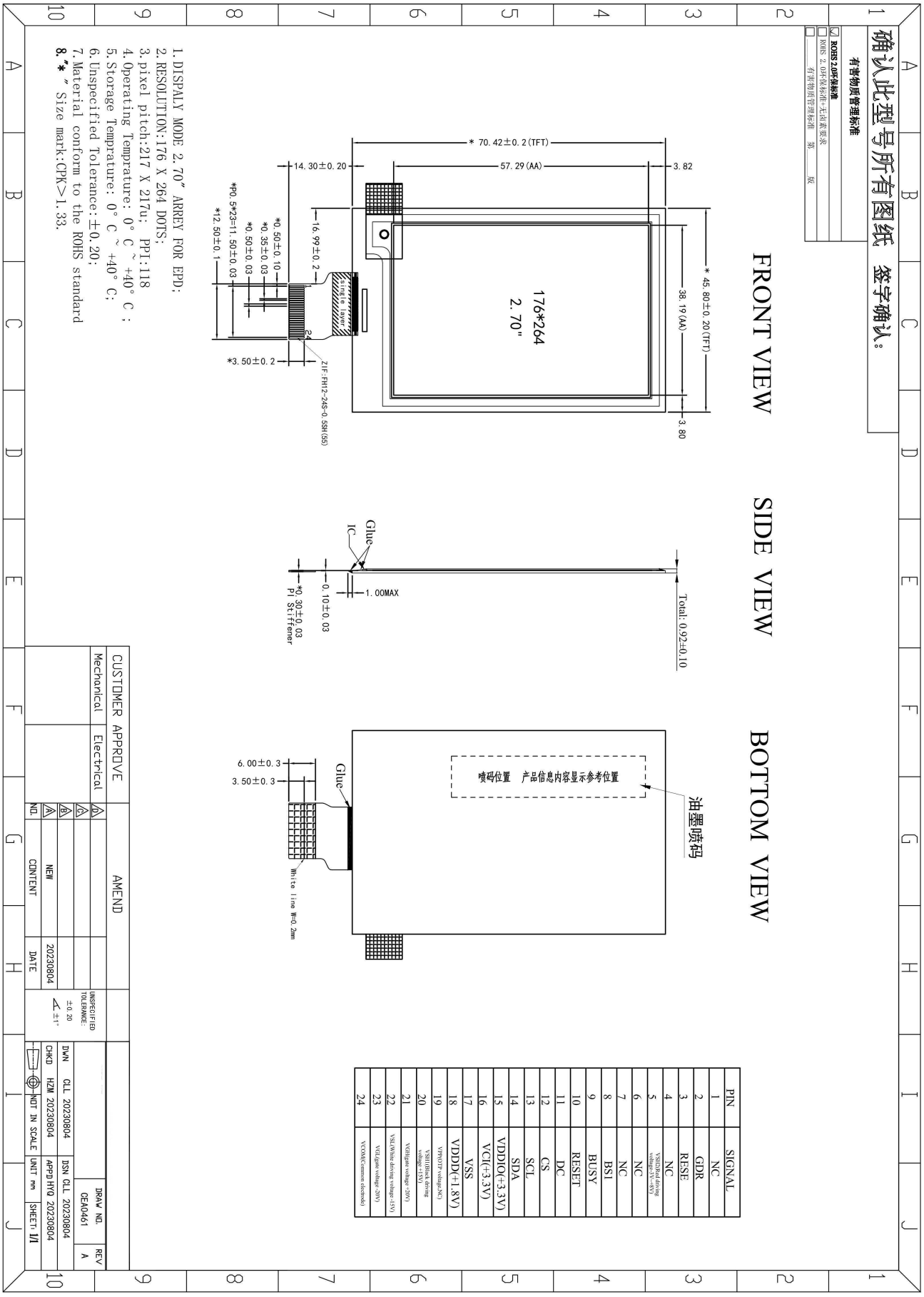
3. Application

Electronic Shelf Label System

4. Mechanical Specifications

Parameter	Specifications	Unit	Remark
Screen Size	2.7	Inch	
Display Resolution	176(H)×264(V)	Pixel	Dpi:118
Active Area	38.192(H)×57.288(V)	mm	
Pixel Pitch	0.217×0.217	mm	
Pixel Configuration	Rectangle		
Outline Dimension	45.80(H)×70.42 (V) ×0.92(D)	mm	
Weight	5.92±0.5	g	

5. **Mechanical Drawing of EPD module**



PIN	SIGNAL
1	NC
2	GDR
3	RESE
4	NC
5	NC
6	NC
7	NC
8	BSI
9	BUSY
10	RESET
11	DC
12	CS
13	SCL
14	SDA
15	VDDIO(+3.3V)
16	VCI(+3.3V)
17	VSS
18	VDDD(+1.8V)
19	VPWOTP voltage(NC)
20	VSH1(Black driving voltage +15V)
21	VGH(gate voltage +20V)
22	VSL(White driving voltage -15V)
23	VGL(gate voltage -20V)
24	VCOM(Common electrode)

6. Input/Output Terminals

Pin #	Single	Description	Remark
1	NC	No connection and do not connect with other NC pins	Keep Open
2	GDR	N-Channel MOSFET Gate Drive Control	
3	RESE	Current Sense Input for the Control Loop	
4	NC	No connection and do not connect with other NC pins	Keep Open
5	VSH2	Positive Source driving voltage	
6	NC	No connection and do not connect with other NC pins	Keep Open
7	NC	No connection and do not connect with other NC pins	Keep Open
8	BS1	Bus selection pin	Note 6-5
9	BUSY	Busy state output pin	Note 6-4
10	RES #	Reset signal input.	Note 6-3
11	D/C #	Data /Command control pin	Note 6-2
12	CS #	The chip select input connecting to the MCU.	Note 6-1
13	SCL	Serial clock pin for interface.	
14	SDA	Serial data pin for interface.	
15	VDDIO	Power input pin for the Interface.	
16	VCI	Power Supply pin for the chip	
17	VSS	Ground (Digital)	
18	VDD	Core logic power pin	
19	VPP	Power Supply for OTP Programming	
20	VSH1	Positive Source driving voltage	
21	VGH	Power Supply pin for Positive Gate driving voltage and VSH	
22	VSL	Negative Source driving voltage	
23	VGL	Power Supply pin for Negative Gate driving voltage, VCOM and VSL	
24	VCOM	VCOM driving voltage	

Note 6-1: This pin (CS#) is the chip select input connecting to the MCU. The chip isenabled for MCU communication: only when CS# is pulled LOW.
Note 6-2: This pin (D/C#) is Data/Command control pin connecting to the MCU. When thepin is pulled HIGH, the data will be interpreted as data. When the pin is pulled LOW, the data will be interpreted as command.
Note 6-3: This pin (RES#) is reset signal input. The Reset is active low.
Note 6-4: This pin (BUSY) is Busy state output pin. When Busy is High ,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 High when the driver IC is working such as:
-Outputting display waveform; or
-Communicating with digital temperature sensor
Note 6-5: This pin (BS1) 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

7. MCU Interface

7.1 MCU interface selection

The SE0270MN12-TNG-A0 can support 3-wire/4-wire serial peripheral interface. In the Module, the MCU interface is pin selectable by BS1 pins shown in.

Table 7-1: MCU interface selection

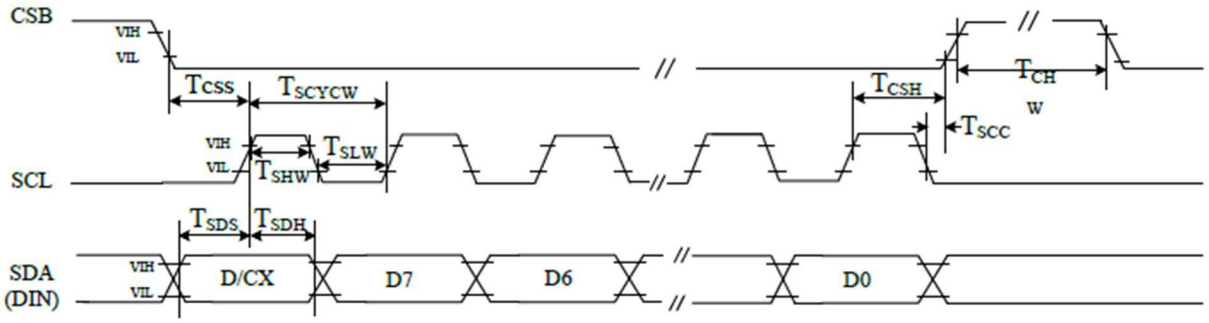
BS1	MPU Interface
L	4-lines serial peripheral interface (SPI)
H	3-lines serial peripheral interface (SPI) - 9 bits SPI

7.2 MCU Serial Peripheral Interface (3-wire SPI)

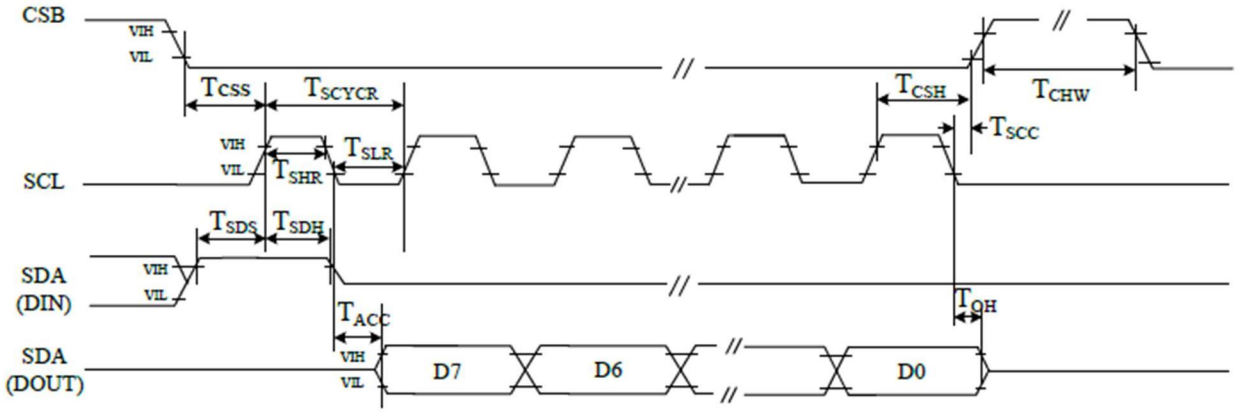
JD79657 use the 3-wire serial port as communication interface for all the function and command setting.

3-Wire communication can be bi-directional controlled by the "R/W" bit in address field. JD79657 3-Wire engine act as a "slave mode" for all the time, and will not issue any command to the 3-Wire bus itself.

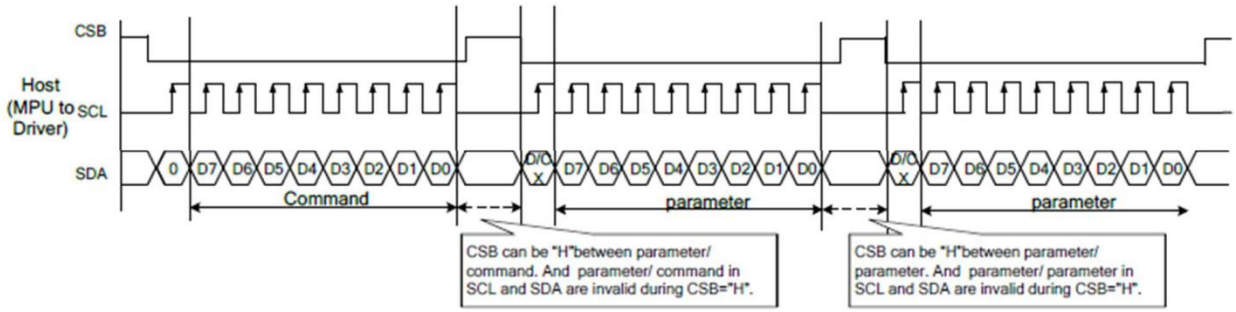
Under read mode, 3-Wire engine will return the data during "Data phase". The returned data should be latched at the rising edge of SCL by external controller. Data in the "Hi-Z phase" will be ignored by 3-Wire engine during write operation, and should be ignored during read operation also. During read operation, external controller should float SDA pin under "Hi-Z phase" and "Data phase".



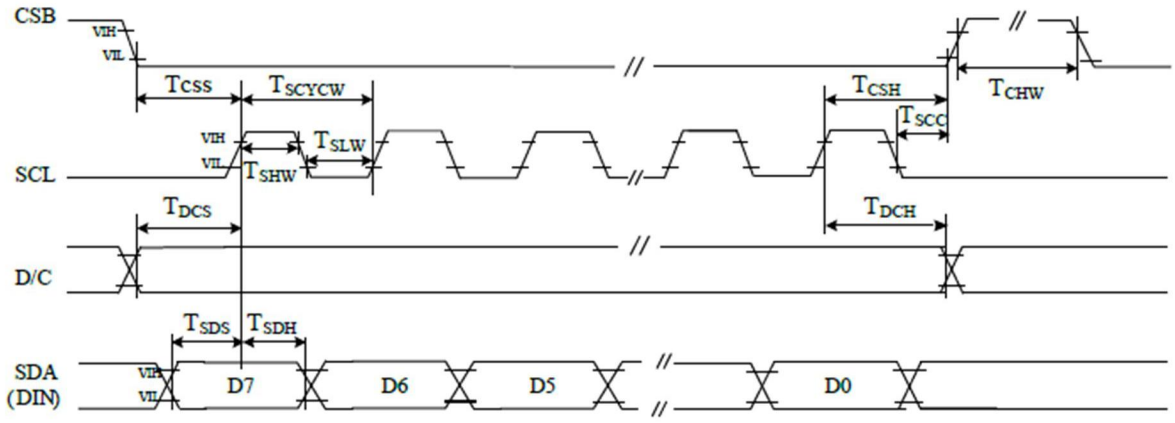
3 pin serial interface characteristics (write mode)



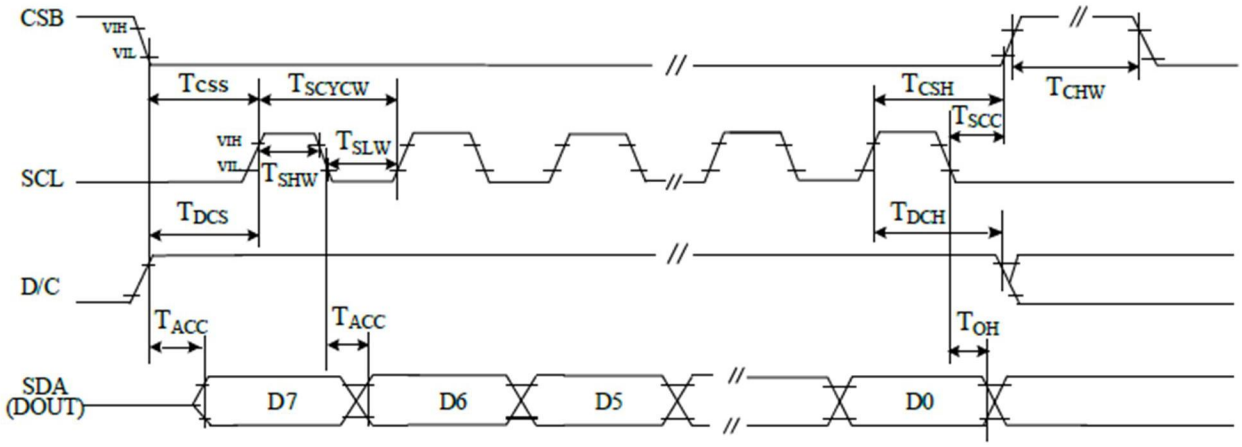
3 pin serial interface characteristics (read mode)



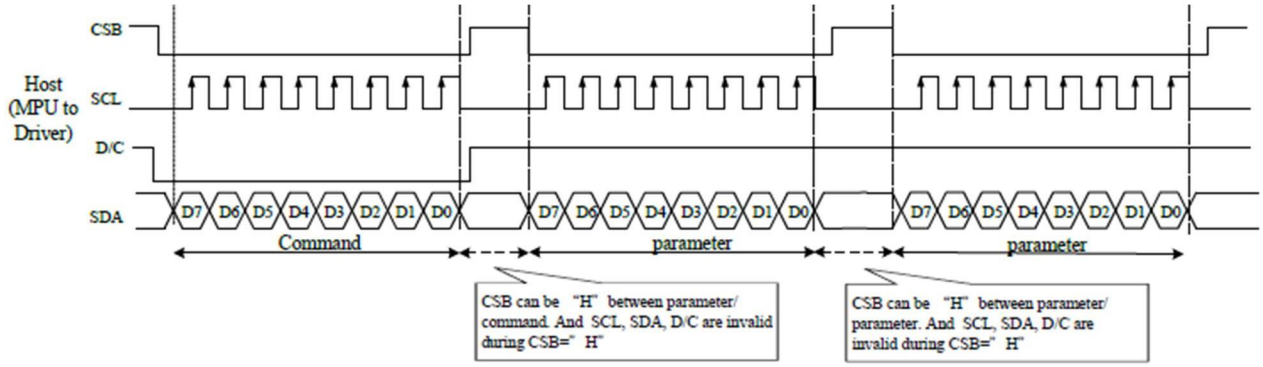
7.3 MCU Serial Peripheral Interface (4-wire SPI)



4 pin serial interface characteristics(write mode)



4 pin serial interface characteristics(read mode)



8. Reference Circuit

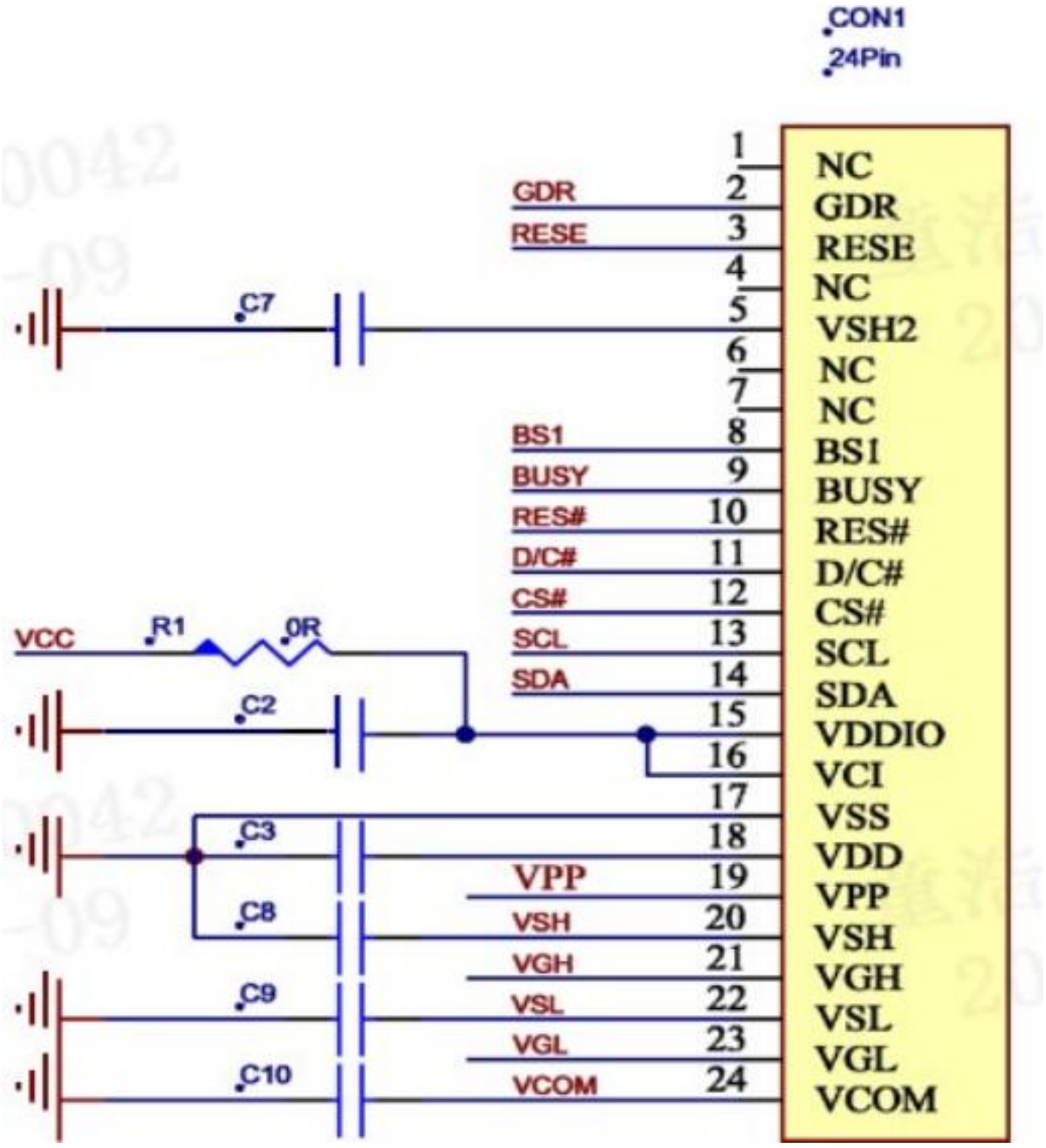


Figure. 8-1

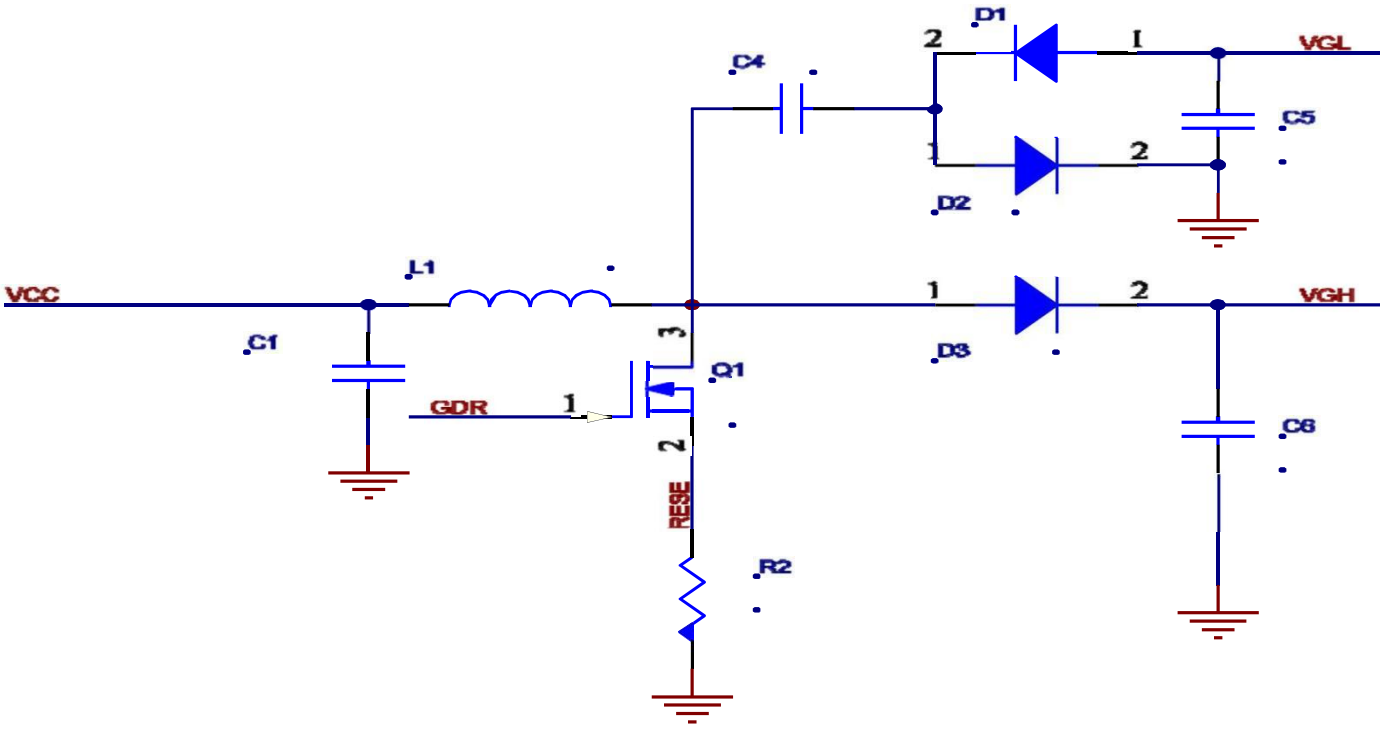


Figure. 8-2

Part Name	JD79651CB Value /quirement/Reference Part
C1	0.1uF/0603;X5R/X7R;Voltage Rating: 25V
C2-C9	1uF/0603;X5R/X7R;Voltage Rating: 25V
C10	0.47uF/0603;X5R/X7R;Voltage Rating: 25V
D1-D3	MBR0530 1. Reverse DC voltage≥30V 2. Forward current≥500mA 3. Forward voltage≤430mV
R2	2.2 Ω/0603： 1% variation
Q1	NMOS:Si1308EDL、Si1304BDL 1. Drain-Source breakdown voltage ≥ 30V 2. Gate-source threshold voltage ≤ 1.5V 3. Rds on≤ 2.1Ω @ Vgs=2.5V
L1	47uH/CDRH2D18、LDNP-470NC Maximum DC current~420mA Maximum DC resistance~650mΩ

9. Absolute Maximum Rating

Table 9-1: Maximum Ratings

Symbol	Parameter	Rating	Unit	Humidity	Unit	Note
V_{CI}	Logic supply voltage	-0.3 to +6.0	V	-	-	
T_{OPR}	Operation temperature range	0 to 40	°C	45 to70	%	Note 9-1
Tttg	Transportation temperature range	-25 to 60	°C	45 to70	%	Note 9-2
Tstg	Storage condition	0 to 40	°C	45 to70	%	Maximum storage time: 5 years
-	After opening the package	0 to 40	°C	45 to70	%	

Note 9-1：We guarantee the single pixel display quality for 0-35℃, but we only guarantee the barcode readable for 35-40℃. Normal use is recommended to refresh every 24 hours.

Note 9-2: Tttg is the transportation condition, the transport time is within 10 days for -25℃~0℃ or 40℃~60℃.

Note 9-3：When the three-color product is stored. The display screen should be kept white and face up. In addition, please be sure to refresh the e-paper every three months.

10.DC CHARACTERISTICS

The following specifications apply for: VSS=0V, VCI=3.3V, T_{OPR}=25℃.

Table 10-1: DC Characteristics

Symbol	Parameter	Test Condition	Applicable pin	Min.	Typ.	Max.	Unit
VCI	VCI operation voltage	-	VCI	2.3	3.3	3.6	V
VIH	High level input voltage	-	SDA, SCL, CS#, D/C#, RES#,BS1	0.7VIO		VIO	V
VIL	Low level input voltage	-		GND	-	0.3VDDIO	V
VOH	High level output voltage	IOH = 400uA	BUSY	VIO-0.4	-	-	V
VOL	Low level output voltage	IOL = -400uA		GND	-	GND+0.4	V
Iupdate	Module operating current	-	-	-	8	-	mA
Isleep	Deep sleep mode (POWER OFF MODE)	VCI=3.3V	-	-	0.4	-	uA

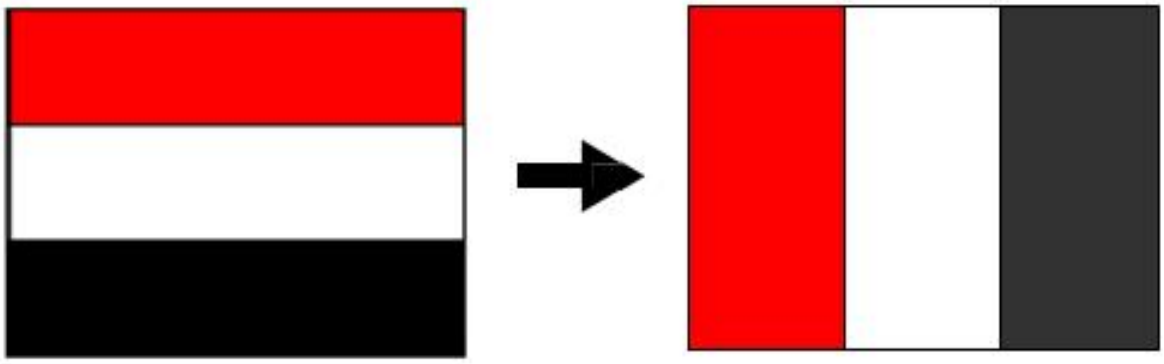
The Typical power consumption is measured using associated 25℃ waveform with following pattern transition: from horizontal scan pattern to vertical scan pattern. (Note10-1)

-The listed electrical/optical characteristics are only guaranteed under thecontroller &waveform provided by SID.

-Vcom value will be OTP before in factory or present on the label sticker.

Note10-1

The Typical power consumption



11.Serial Peripheral Interface Timing and Command Table.

11.1 Serial Peripheral Interface Timing

The following specifications apply for: VSS=0V, VCI=2.2V to 3.6V, T_{OPR}=25℃ , CL=20pF

Write mode

Symbol	Parameter	Min	Typ	Max	Unit
fSCL	SCL frequency (Write Mode)			20	MHz
tCSSU	Time CS# has to be low before the first rising edge of SCLK	20			ns
tCSHLD	Time CS# has to remain low after the last falling edge of SCLK	20			ns
tCSHIGH	Time CS# has to remain high between two transfers	100			ns
tSCLHIGH	Part of the clock period where SCL has to remain high	25			ns
tSCLLOW	Part of the clock period where SCL has to remain low	25			ns
tSISU	Time SI (SDA Write Mode) has to be stable before the next rising edge of SCL	10			ns
tSIHLD	Time SI (SDA Write Mode) has to remain stable after the rising edge of SCL	40			ns

Read mode

Symbol	Parameter	Min	Typ	Max	Unit
fSCL	SCL frequency (Read Mode)			2.5	MHz
tCSSU	Time CS# has to be low before the first rising edge of SCLK	100			ns
tCSHLD	Time CS# has to remain low after the last falling edge of SCLK	50			ns
tCSHIGH	Time CS# has to remain high between two transfers	250			ns
tSCLHIGH	Part of the clock period where SCL has to remain high	180			ns
tSCLLOW	Part of the clock period where SCL has to remain low	180			ns
tSOSU	Time SO(SDA Read Mode) will be stable before the next rising edge of SCL		50		ns
tSOHLD	Time SO (SDA Read Mode) will remain stable after the falling edge of SCL		0		ns

Note: All timings are based on 20% to 80% of VDDIO-VSS

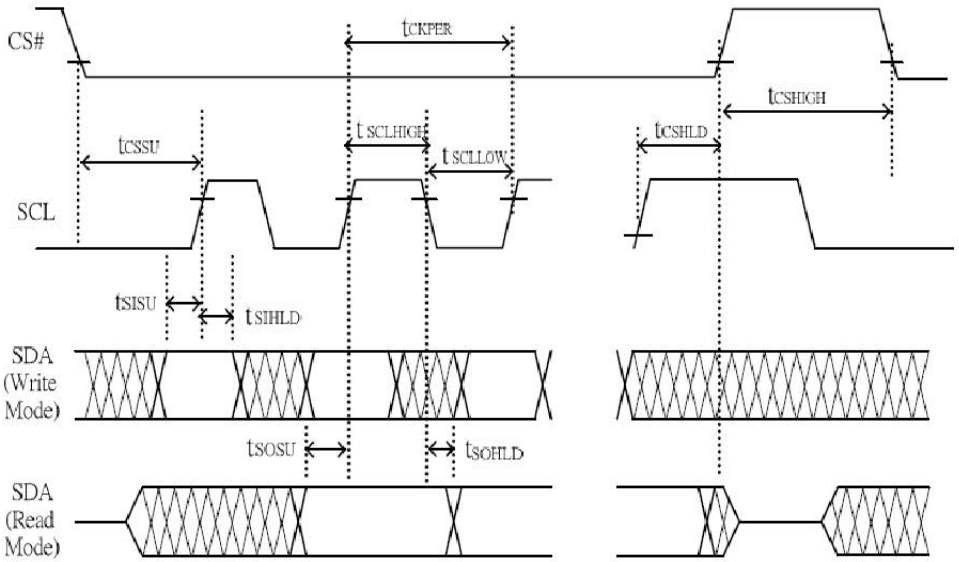


Figure 11-1: SPI timing diagram

11.2 Command Table

Please refer to IC Spec.

12. Power Consumption

Parameter	Symbol	Conditions	TYP	Max	Unit	Remark
Panel power consumption during update	-	25℃	-	120	mAs	-
Deep sleep mode	-	25℃	-	0.4	uA	POWER OFF MODE

mAs=update average current × update time（Please refer to the actual test results）

13. Power ON/OFF Sequence

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

Power ON Sequence

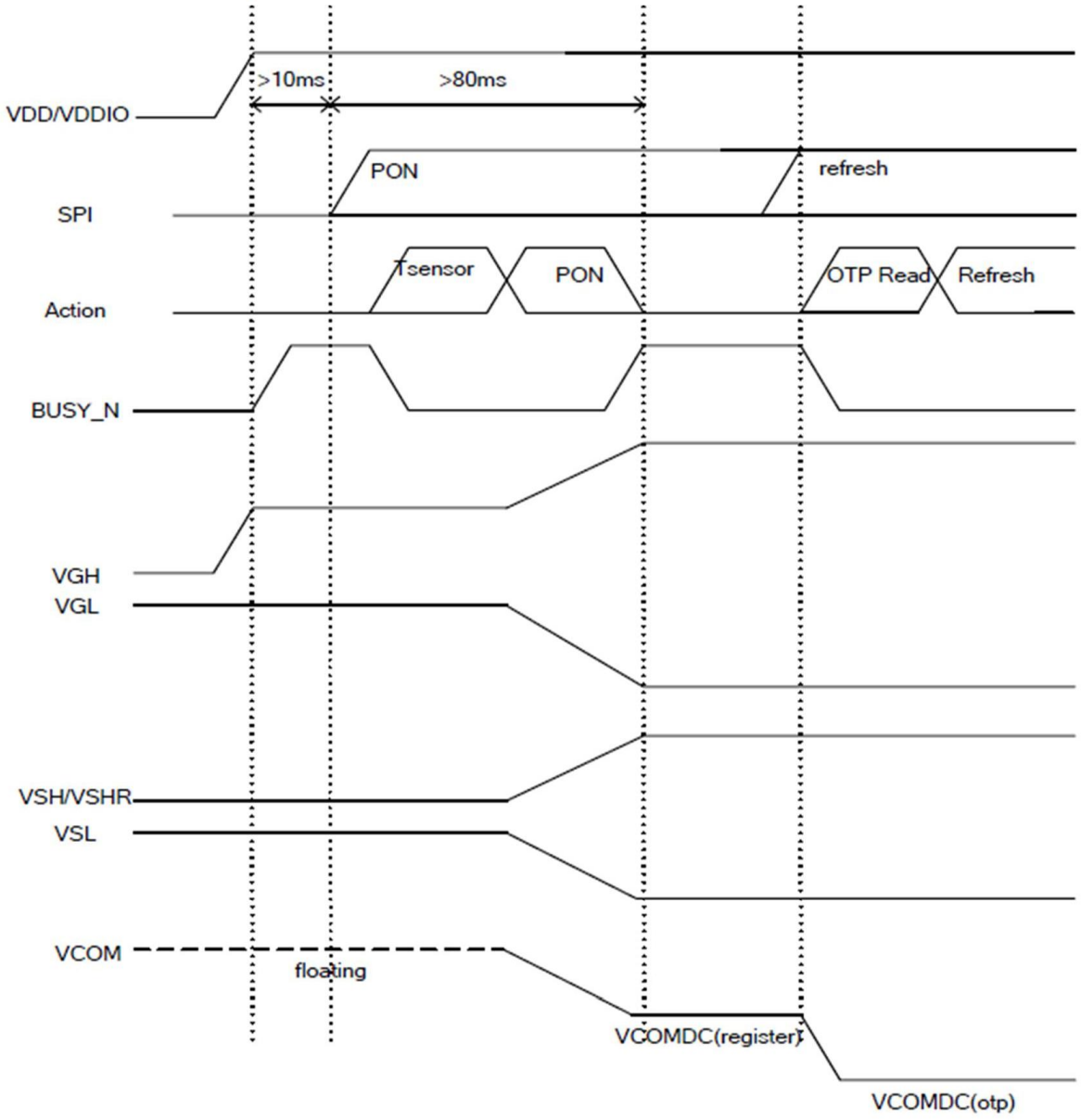


Figure 1: Power on sequence

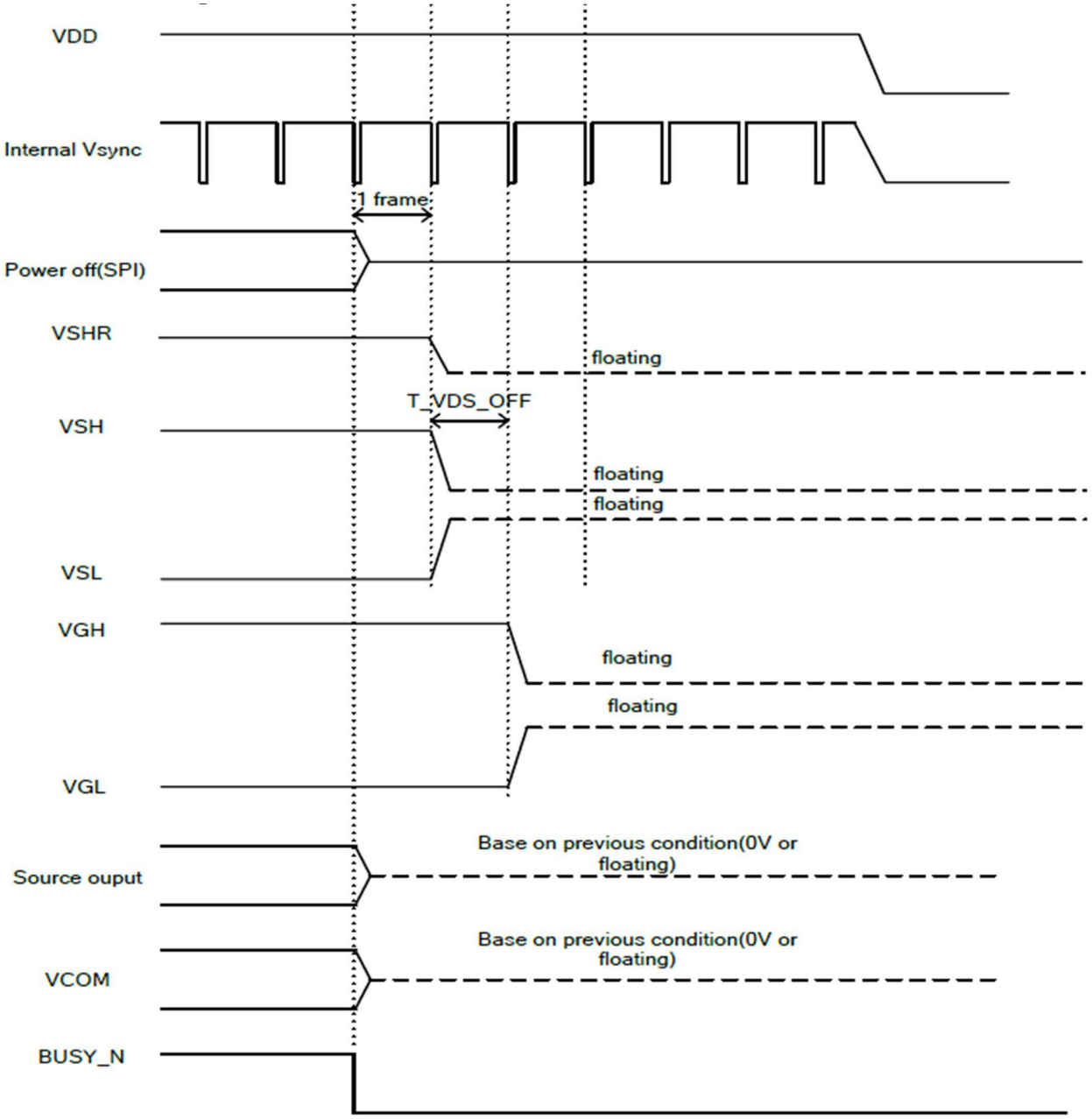


Figure 2: Power off sequence

14. Optical characteristics

14.1 Specifications

Measurements are made with that the illumination is under an angle of 45 degrees, the detection is perpendicular unlessotherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX	UNIT	Note
R	Reflectance	White	30	35	-	%	Note 14-1
CR	Contrast Ratio	-	15	20	-		-
Gn	2Grey Level	-	-	KS+(WS-KS)×n(m-1)	-	L*	-
KS	Black State L* value		-	-	14		Note 14-1
	Black State a* value		-	-	6		Note 14-1
WS	White State L* value		62	65	-		Note 14-1
RS	Red State L* value	Red	25	28	-		Note 14-1
	Red State a* value	Red	36	40	-		Note 14-1
Panel’s life	-	0℃～40℃		5years	-	-	Note 14-2
Panel	Image Update	Storage and transportation	-	Update the white screen	-	-	-
	Update Time	Operation	-	Suggest Updated once a day	-	-	-

WS : White state, KS : Black state, RS: Red state

Note 14-1 : Luminance meter : i - One Pro Spectrophotometer

Note 14-2:We don't guarantee 5 years pixels display quality for humidity below 45%RH or above 70%RH; Suggest Updated once a day;

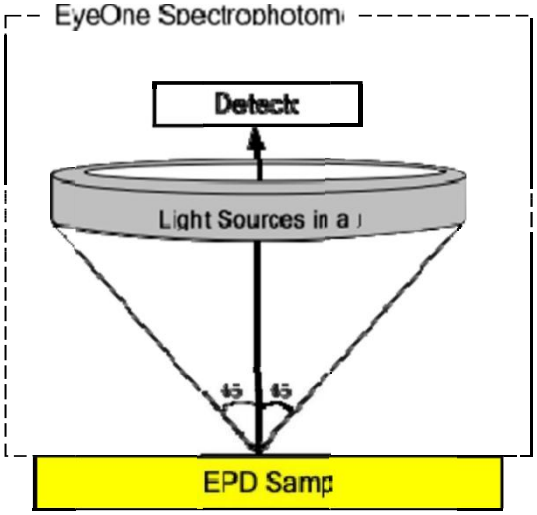
Note 14-3: To increases the black and white screen clear screen when red has refreshed for a long time , the effect is better。

14.2 Definition of contrast ratio

The contrast ratio (CR) is the ratio between the reflectance in a full white area (R1) and the reflectance in a dark area (Rd)() :

R1: white reflectance Rd: dark reflectance

CR = R1/Rd

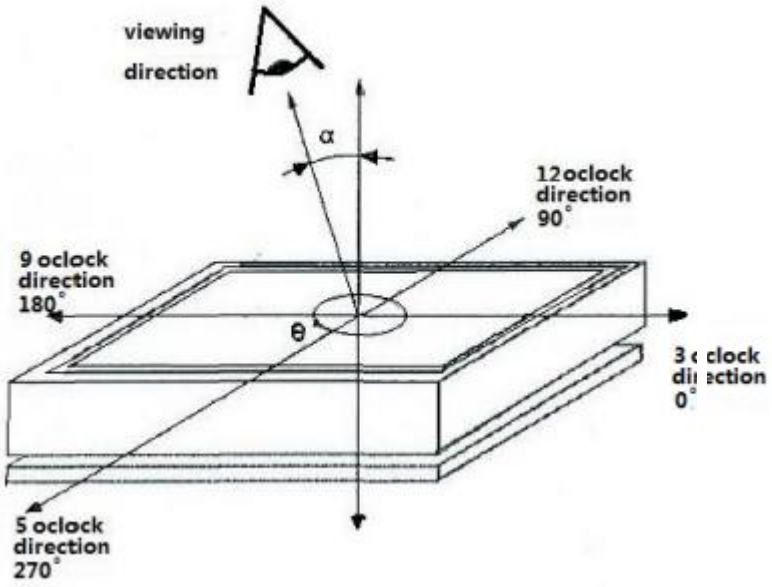


14.3 Reflection Ratio

The reflection ratio is expressed as:

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

L_{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 whiteboard. Both are measured with equivalent illumination source. The viewing angle shall be no more than 2 degrees.



15. HANDLING, SAFETY AND ENVIROMENTAL REQUIREMENTS

WARNING
The display module should be kept flat or fixed to a rigid, curved support with limited bending along thelong axis. It should not be used for continual flexing and bending. Handle with care. Should the display break do not touch any material that leaks out. In case of contact with the leaked material then wash withwater 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 generatescorrosive 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 donot rub with dust clothes with chemical treatment. Do not touch the surface of PS for bare hand or greasy cloth. (Somecosmetics deteriorate the PS)
(6) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soakswith 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 colorfading.

Data sheet status	
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.

16. Reliability test

	TEST	CONDITION	REMARK
1	High-Temperature Operation	T=50℃, RH=30%RH, For 240Hr	
2	Low-Temperature Operation	T = 0℃ for 240 Hr	
3	High-Temperature Storage	T=60℃ RH=35%RH For 240Hr	Test in white pattern
4	Low-Temperature Storage	T = -25℃ for 240 Hr	Test in white pattern
5	High Temperature, High-Humidity Operation	T=40℃,RH=90%RH, For 168Hr	
6	High Temperature, High-Humidity Storage	T=60℃,RH=80%RH,For 240Hr	Test in white pattern
7	Temperature Cycle	-25℃(30min)~60℃(30min),50 Cycle	Test in white pattern
8	Package Vibration	1.04G,Frequency : 20~200Hz Direction : X,Y,Z Duration: 30 minutes in each direction	Full packed for shipment
9	Package Drop Impact	Drop from height of 100 cm on Concrete surface Drop sequence:1 corner, 3edges, 6face One drop for each.	Full packed for shipment
10	Electrostatic discharge	HBM:330Ω,150pF	Air +/-4KV;Contact +/-2KV
11	UV Exposure Resistance	765 W/㎡ for 168hrs,40 ℃	

Actual EMC level to be measured on customer application.

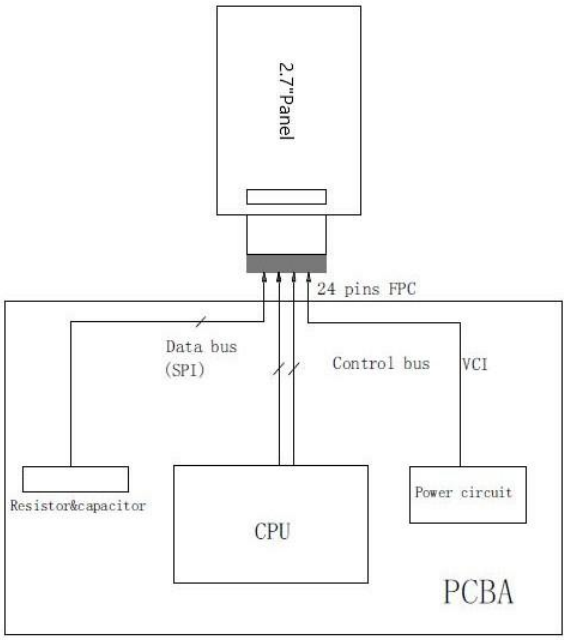
Note1：Stay white pattern for storage and non-operation test.

Note2：Operation is black/white/red pattern , hold time is 150S.

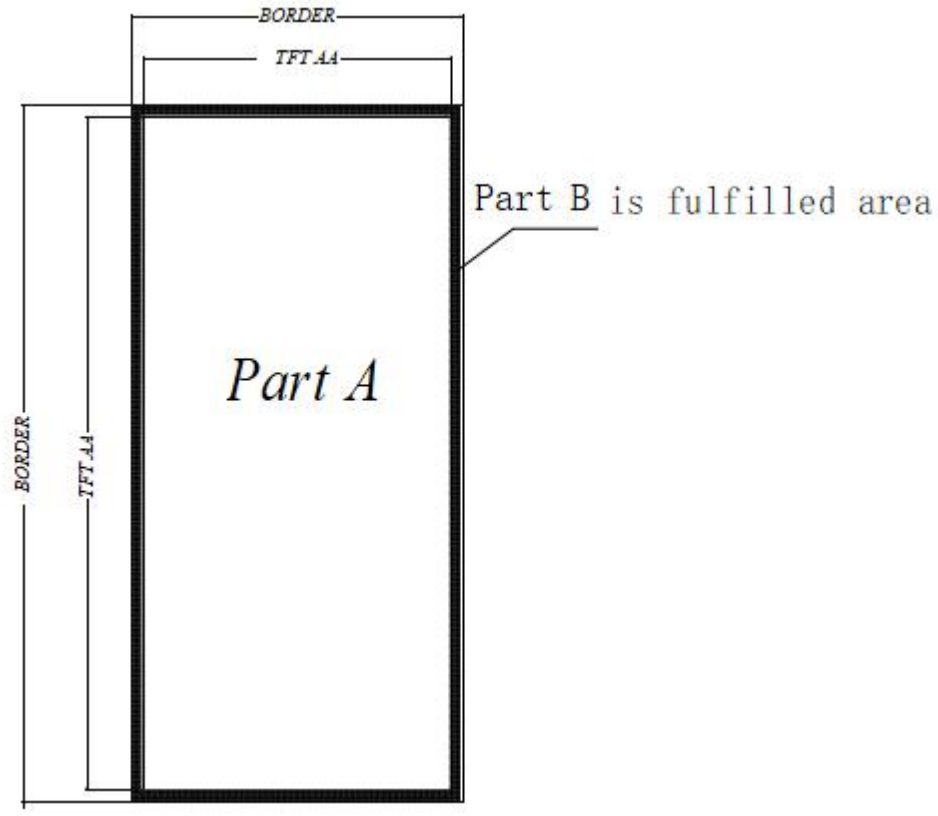
Note3：The function ,appearance, opticals should meet the requirements of the test before and after the test.

Note4: Keep testing after 2 hours placing at 20℃-25℃

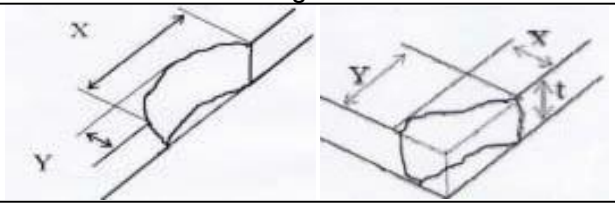
17. Block Diagram



18. PartA/PartB specification



19. Point and line standard

<table>
<tr><th colspan="7">Shipment Inspection Standard</th></tr>
<tr><td colspan="7">Equipment：Electrical test fixture, Point gauge</td></tr>
<tr><td>Outline dimension</td><td>45.80(H)×70.42 (V)
×0.92(D)</td><td>Unit：㎜</td><td>Part-A</td><td>Active area</td><td>Part-B</td><td>Border area</td></tr>
<tr><td rowspan="2">Environment</td><td>Temperature</td><td>Humidity</td><td>Illuminance</td><td>Distance</td><td>Time</td><td>Angle</td></tr>
<tr><td>19℃～25℃</td><td>55%±5% RH</td><td>600～1200Lux</td><td>300 ㎜</td><td>35Sec</td><td></td></tr>
<tr><td>Defect type</td><td>Inspection method</td><td colspan="2">Standard</td><td colspan="2">Part-A</td><td>Part-B</td></tr>
<tr><td rowspan="4">Spot</td><td rowspan="4">Electric Display</td><td colspan="2">D≤0.2 ㎜</td><td colspan="2">Ignore</td><td>Ignore</td></tr>
<tr><td colspan="2">0.2㎜＜D≤0.4 ㎜</td><td colspan="2">N≤4</td><td>Ignore</td></tr>
<tr><td colspan="2">0.4㎜＜D≤0.6 ㎜</td><td colspan="2">N≤1</td><td>Ignore</td></tr>
<tr><td colspan="2">D>0.6mm</td><td colspan="2">Not Allow</td><td></td></tr>
<tr><td>Display unwork</td><td>Electric Display</td><td colspan="2">Not Allow</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td>Display error</td><td>Electric Display</td><td colspan="2">Not Allow</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td rowspan="3">Scratch or line defect(include dirt)</td><td rowspan="3">Visual/Film card</td><td colspan="2">L≤2 ㎜,W≤0.1 ㎜</td><td colspan="2">Ignore</td><td>Ignore</td></tr>
<tr><td colspan="2">1.0mm＜L≤9.0mm,0.1＜W≤0.2mm,</td><td colspan="2">N≤2</td><td>Ignore</td></tr>
<tr><td colspan="2">L＞9 ㎜,W＞0.2㎜</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td rowspan="3">PS Bubble</td><td rowspan="3">Visual/Film card</td><td colspan="2">D≤0.4mm</td><td colspan="2">Ignore</td><td>Ignore</td></tr>
<tr><td colspan="2">0.4mm≤D≤0.6mm</td><td colspan="2">N≤4</td><td>Ignore</td></tr>
<tr><td colspan="2">D＞0.6 mm</td><td colspan="2">Not Allow</td><td>Ignore</td></tr>
<tr><td>Side Fragment</td><td>Visual/Film card</td><td colspan="5">Do not affect the electrode circuit (Edge chipping)X≤8mm,Y≤1mm,Do not affect the electrode circuit((Corner chipping)
Ignore
  </td></tr>
</table>

Remark	
	1.Cannot be defect & failure cause by appearance defect；
	2.Cannot be larger size cause by appearance defect；
	L=long W=wide D=point size N=Defects NO

Note1 : OQC inspection: One-time sampling plan for GB/T 2828.1-2012 , Inspection Level II, CR: AC/Re=0/1, MA=0.4, MI=0.65.
Note2: Spot define: That only can be seen under White State or Dark State defects
Note3: Any defect which is visible under gray pattern or transition process but invisible under black and white is disregarded.

Note4:Any defect must be judged by Optical Microscope.

Note5:Here is definition of the “Spot” and “Scratch or line defect”

Spot: W>1/4L

Scratch or line defect :W ≤ 1/4L

Note6:Definition for L/W and D （major axis）

Note7：FPC bonding area pad doesn’t allowed visual inspection

Note8：