Product Specification

（Common Application）

Product Name: VGM160160A3W01

Product Code: M03420

Customer
Approved by Customer
Approved Date:

Designed By	Checked By	Approved By	
		R&D	QA

CONTENT

REVISION RECORD

REV.	REVISION DESCRIPTION	REV. DATE	REMARK
Y01	Initial release.	2020-06-15	
Y02	Update logo Remove External DC-DC application circuit Update Electrical Characteristics Update Reliability	2022-07-23	ALL Page 9 Page18

1 Application filed

Common Application

2 Overview

VGM160160A3W01 is an OLED gray scale display module with 160×160 dot matrix. The characteristics of this display module are high brightness, self-emission, high contrast ratio, slim/thin outline, wide viewing angle, wide temperature range, and low power consumption.

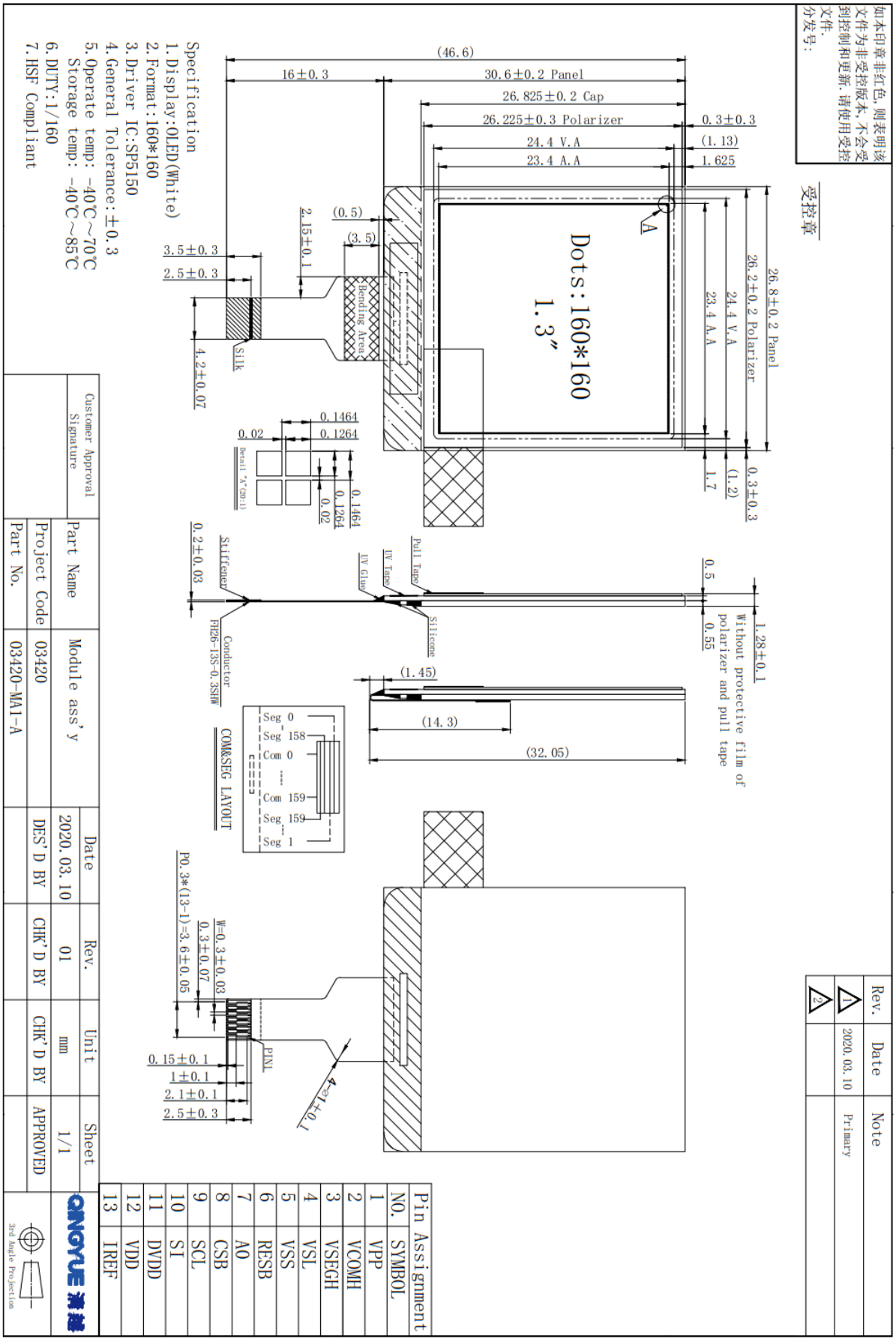
3 Features

- Display Color: White
- Dot Matrix:160×160
- Driver IC: SP5150
- Interface: 4-Wire SPI.
- Wide range of operating temperature: -40℃ to 70℃
- Wide range of Storage temperature: -40℃ to 85℃

4 Mechanical Data

NO.	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	160(W)×160(H)	-
2	Dot Size	0.1264(W)×0.1264(H)	mm^2
3	Dot Pitch	0.1464(W)×0.1464(H)	mm^2
4	Aperture Rate	74.5	%
5	Active Area	23.4(W)×23.4(H)	mm^2
6	Panel Size	26.8W)×30.6(H) ×1.05(T)	mm^3
7	Module Size	26.8(W)×46.6(H) ×1.28(T)	mm^3
8	Diagonal A/A Size	1.3	inch
9	Module Weight	TBD±10%	g

5 Mechanical Drawing

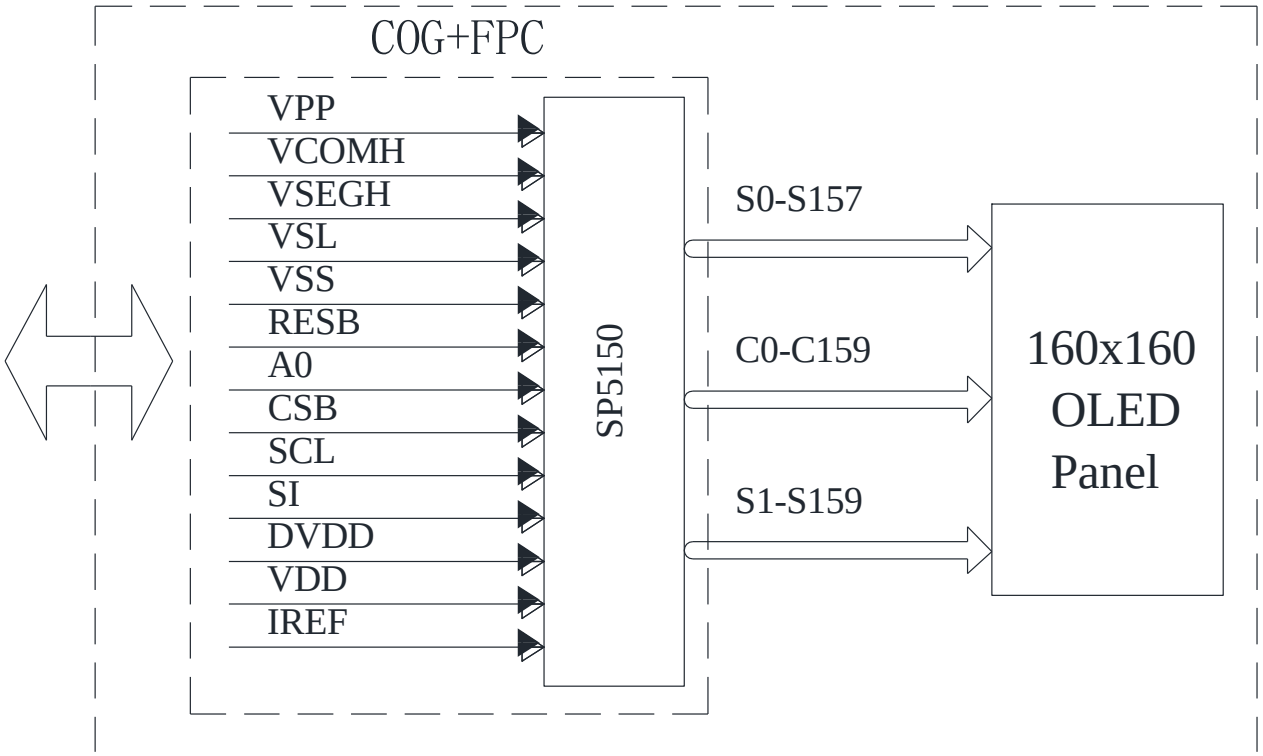


Pin Assignment	
NO.	SYMBOL
1	VPP
2	VCOMH
3	VSEGH
4	VSL
5	VSS
6	RESB
7	A0
8	CSB
9	SCL
10	SI
11	DVDD
12	VDD
13	IREF

6 Module Interface

PIN NO.	PIN NAME	DESCRIPTION
1	VPP	This is the most positive voltage supply pad of the chip It should be supplied externally.
2	VCOMH	This is a pad for the voltage output high level for common signals A capacitor should be connected between this pad and VSS
3	VSEGM	This is a segment pre-charge voltage. A capacitor can be connected between this pad and VSS if necessary. When external capacitor is not used, this pin should be kept NC on FPC.
4	VSL	Discharge voltage level pad. This pad should be connected to resistor and diode externally.
5	VSS	Ground
6	RESB	This is a reset signal input pad. When RES is set to “L”, the settings are initialized. The reset operation is performed by the RES signal level.
7	A0	This is the Data/Command control pad that determines whether the data bits are data or a command. A0 = “H”: the inputs at SCL and SI are treated as display data. A0 = “L”: the inputs at SCL and SI are transferred to the command registers.
8	CSB	This pad is the chip select input. When CS = “L”, then the chip select becomes active, and data/command I/O is enabled.
9	SCL	The Serial Clock Input Signal.
10	SI	The Serial Data Input Signal.
11	DVDD	This pin is for regulator circuit. A capacitor should be connected between this pad and GND if necessary. When external capacitor Is not used, this pin should be kept NC.
12	VDD	1.65V– 3.5V Power supply for logic and input/output
13	IREF	This is a segment current reference pad A resistor should be connected between this pad and VSS

7 Function Block Diagram



8 Absolute Maximum Ratings

ITEM	SYMBOL	MIN	MAX	UNIT	REMARK
Logic supply voltage	VDD	-0.3	+3.5	V	IC maximum rating
OLED Operating Voltage	VPP	-0.3	+15	V	IC maximum rating
Operating Temp.	Top	-40	+70	℃	-
Storage Temp	Tstg	-40	+85	℃	-

Note (1): All of the voltages are on the basis of "VSS = 0V".

Note (2): Permanent breakage of module may occur if the module is used beyond the maximum rating. The module can be normal operated under the conditions according to Section 9 "Electrical Characteristics". Malfunctioning of the module may occur and the reliability of the module may deteriorate if the module is used beyond the conditions.

9 Electrical Characteristics

9.1 DC Electrical Characteristics

ITEM	SYMBOL	TEST CONDITION	MIN	TYPE	MAX	UNIT
Logic Supply Voltage	VDD	22±3°C, 55±15%R.H	1.65	3.0	3.5	V
OLED Driver Supply Voltage	VPP	22±3°C, 55±15%R.H	12.5	13	13.5	V
High-level Input Voltage	V_{IHC}	-	0.8×VDD	-	VDD	V
Low-level Input Voltage	V_{ILC}	-	VSS	-	0.2×VDD	V
High-level Output Voltage	V_{OHC}	-	0.8×VDD	-	VDD	V
Low-level Output Voltage	V_{OLC}	-	VSS	-	0.2×VDD	V

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

9.2 Electro-optical Characteristics

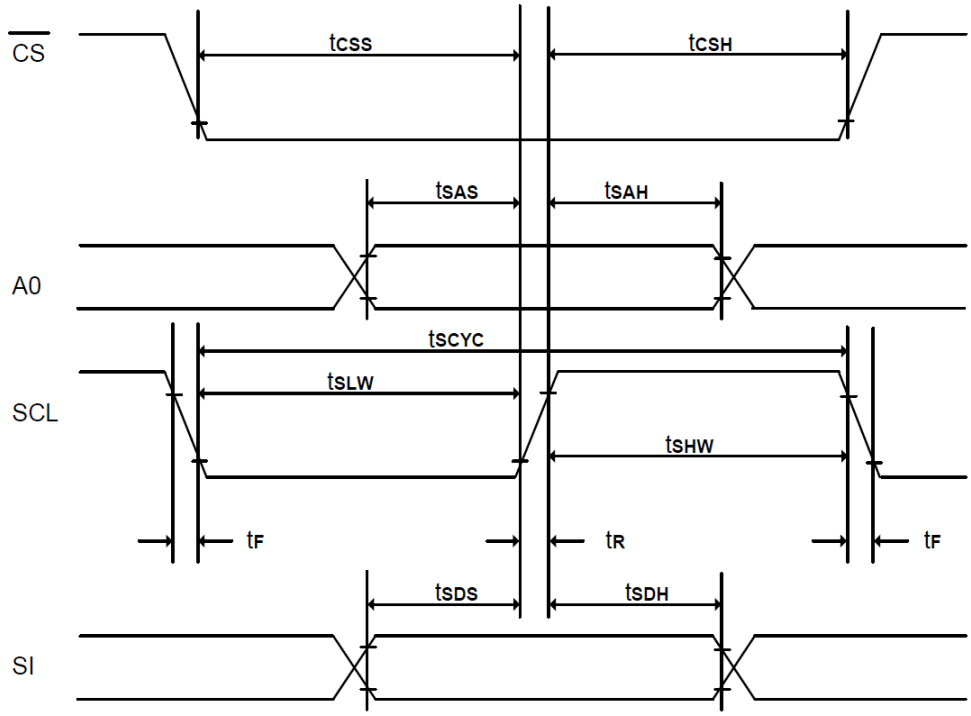
ITEM	SYMBOL	TEST CONDITION	MIN	TYPE	MAX	UNIT
Normal Mode Brightness	L_{br}	All pixels ON (1)	95	120	-	cd/m^2
Normal Mode Power Consumption	Pt	All pixels ON (1)	-	513.5	669.5	mW
Sleep mode current consumption in VDD (DVDD regulator off)	I_{SP}	During sleep, TA = +25℃, VDD = 1.65~2V	-	-	20	uA
Sleep mode current consumption in VDD (DVDD regulator on)		During sleep, TA = +25℃, VDD = 2~3.5V	-	-	30	uA
Sleep mode current consumption in VPP		During sleep, TA = +25℃, VPP = 13	-	-	10	uA
C.I.E(White)	(X)	x,y(CIE1931)	0.26	0.30	0.34	-
	(Y)		0.29	0.33	0.37	-
Dark Room Contrast	CR	-	10000:1	-	-	-
Response Time	-	-	-	10	-	μs
View Angle	-	-	>160	-	-	Degree

Note(1): Normal Mode test conditions are as follows:

- Driving voltage: 13V.
- Contrast setting: 0XFF
- Frame rate: 100Hz
- Duty setting: 1/160

9.3 AC Electrical Characteristics

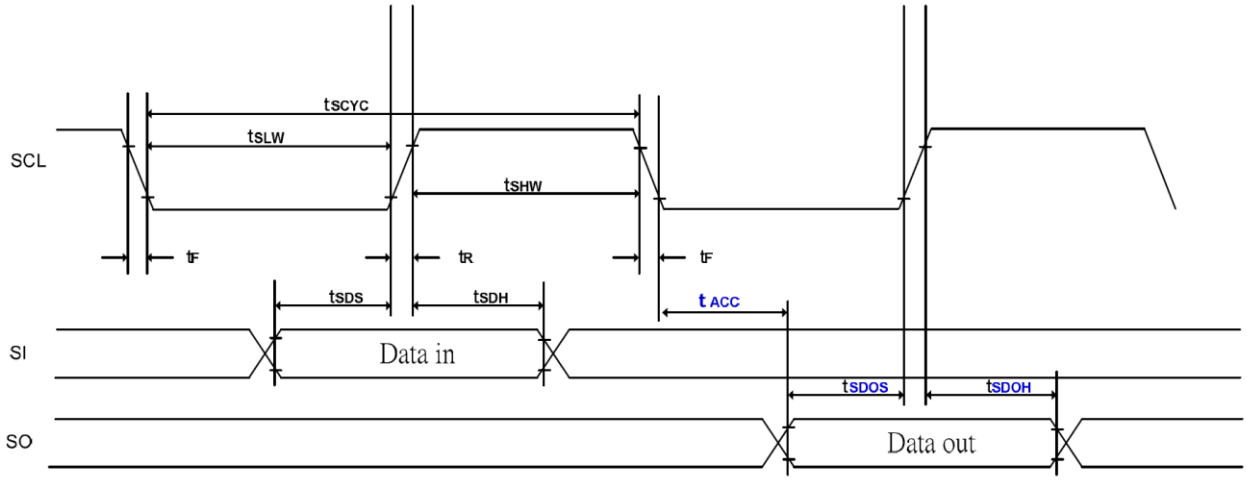
System buses Write characteristics (For 4 wire SPI)



(VDD = 1.65V to 3.5V, TA = 25℃)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tSCYC	Serial clock cycle	50	-	-	ns	
tSAS	Address setup time	30	-	-	ns	
tSAH	Address hold time	30	-	-	ns	
tSDS	Data setup time	20	-	-	ns	
tSDH	Data hold time	20	-	-	ns	
tCSS	$\overline{CS}$ setup time	45	-	-	ns	
tCSH	$\overline{CS}$ hold time time	12	-	-	ns	
tSHW	Serial clock H pulse width	20	-	-	ns	
tSLW	Serial clock L pulse width	20	-	-	ns	
tR	Rise time	-	-	3	ns	
tF	Fall time	-	-	3	ns	

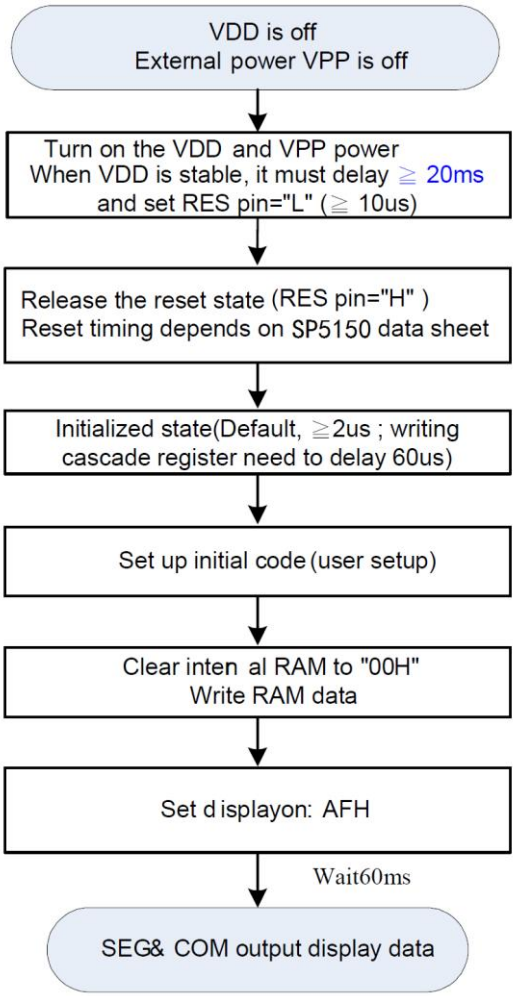
System buses Read characteristics (For 4 wire SPI)



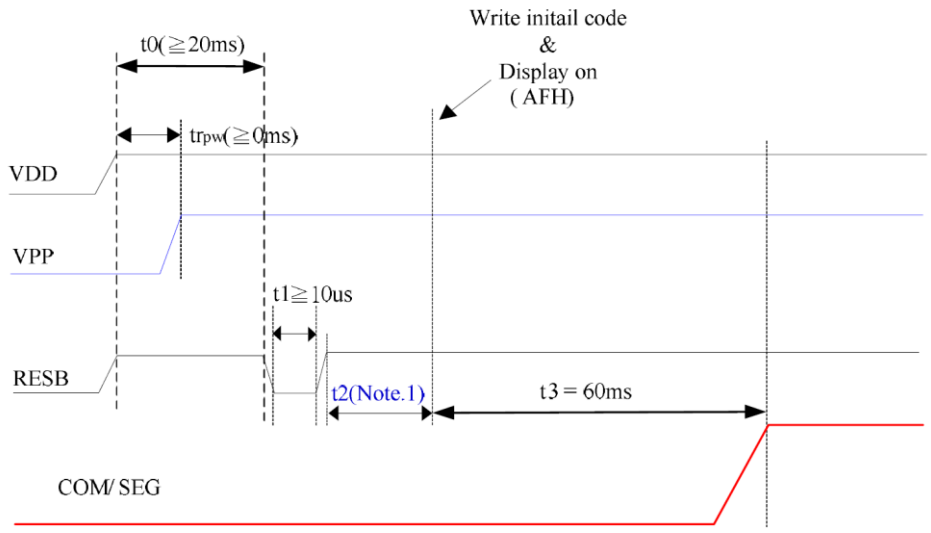
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tACC	Serial clock cycle	10	-	-	ns	
tSDOS	Address setup time	10	-	-	ns	
tSDOH	Address hold time	10	-	-	ns	

10 Functional Specification and Application Circuit

10.1 Power ON and Power OFF Sequence



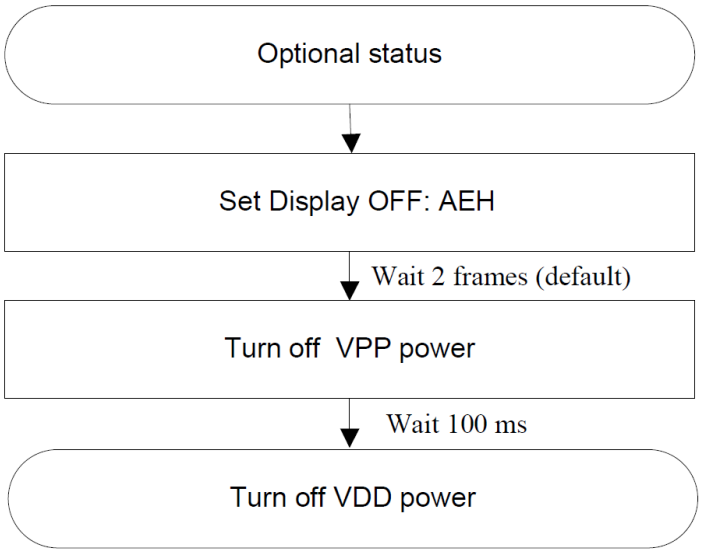
Power ON Sequence:



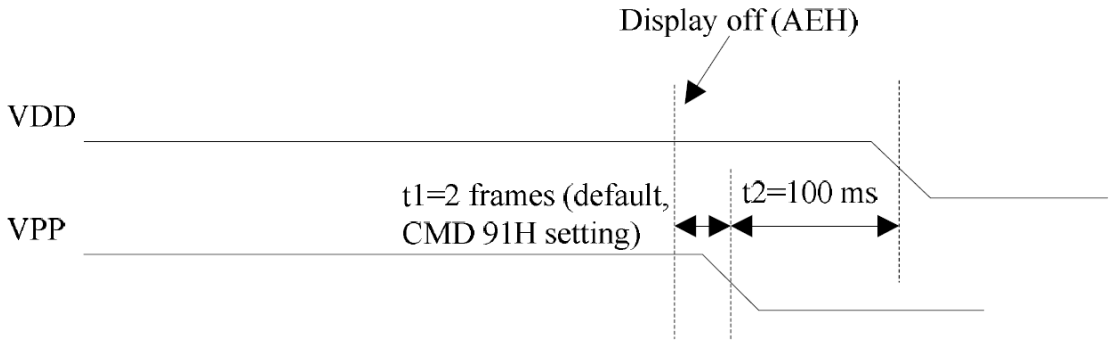
Note. It is necessary to do hardware reset in power on sequence.

Note.1 the delay time t2 is needed 2us.

Power OFF



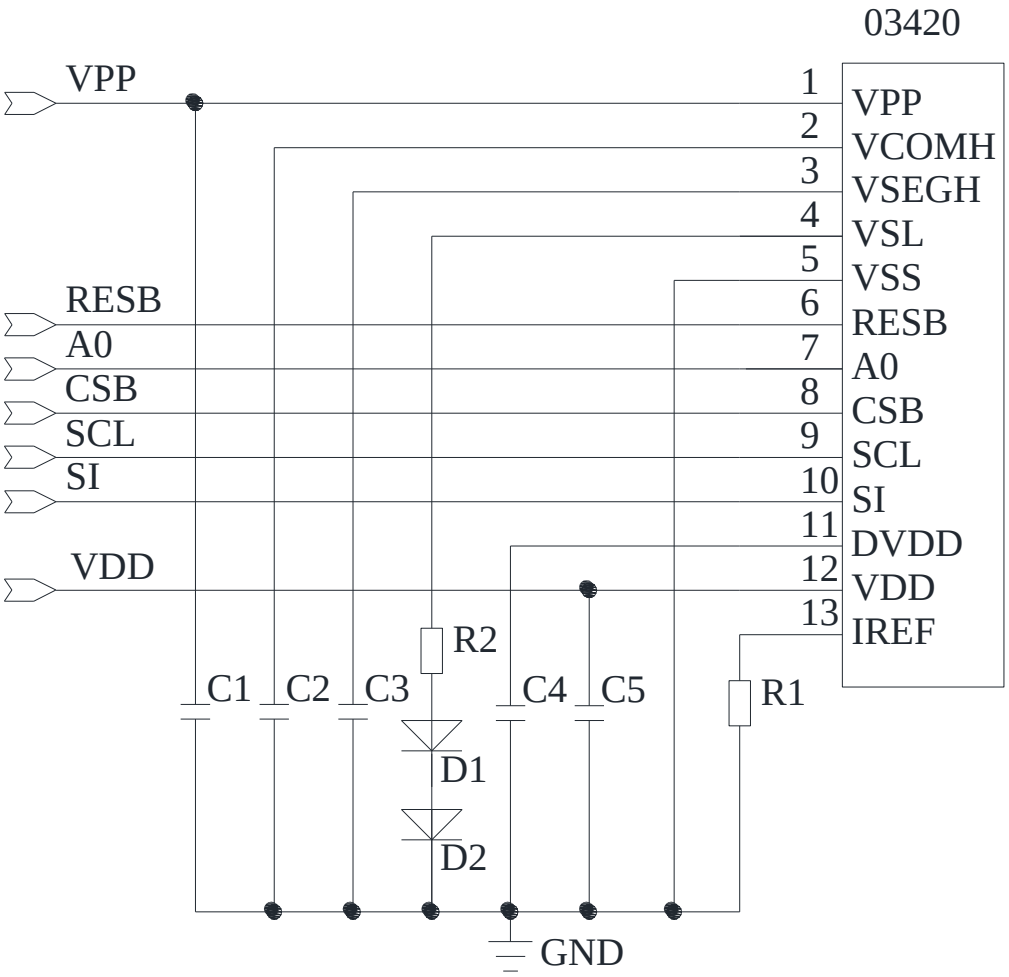
Power OFF Sequence：



Note：There will be no damages to the display module if the power sequences are not met.

10.2 Application Circuit

10.2.1 The configuration for 4-wire SPI mode, external VPP is shown in the following diagram:



Pin connected to MCU interface: SI, SCL, CSB, A0, RESB.

Recommended components

C1~C5: 4.7uF-0603-X7R ±10%.RoHS

R1: 0603 1/10W +/-5% 560KΩ.RoHS

R2: 0603 1/10W +/-5% 51Ω.RoHS

D1, D2: 1N4148W.RoHS

10.3 Display Control Instruction

Refer to SP5150 IC Specification.

10.4 Recommended Software Initialization

In order to ensure the reliability and stability of the module, the module must initialized use the following code, Malfunctioning of the module may occur and the reliability of the module may deteriorate if the module is used beyond the initialize code.

```
void Init_IC()
{
   Write_Command(0xAE);        //Set Display Off
   Write_Command(0x10);        //Set Higher Column Address of Display RAM
   Write_Command(0x00);        //Set Lower Column Address of Display RAM
   Write_Command(0xB0);        //Row Address Mode Setting
   Write_Command(0x00);
   Write_Command(0x21);
   Write_Command(0x00);
   Write_Command(0x4F);
   Write_Command(0x22);
   Write_Command(0x00);
   Write_Command(0x9F);
   Write_Command(0x81);        //The Contrast Control Mode Set
   Write_Command(0xFF);
   Write_Command(0x47);
   Write_Command(0x31);
   Write_Command(0xAD);        //Set External or Internal IREF
   Write_Command(0x80);        //External Resistor And Disable ISEG Adjust
   Write_Command(0xA0);        //Set Segment Re-map
   Write_Command(0xA4);        //Set Entire Display OFF/ON
   Write_Command(0xA6);        //Set Normal/Reverse Display
   Write_Command(0xA8);        //Set Multiplex Ration
   Write_Command(0x9F);
   Write_Command(0xAC);        //Set Grayscale/Mono Display Mode
   Write_Command(0x00);        //Grayscale Mode And Power Increasing Mode
   Write_Command(0xBA);        //Set Linear Gray Scale Table Setting
   Write_Command(0xC8);        //Set Common Output Scan Direction
   Write_Command(0xD3);        //Set Display Offset
   Write_Command(0x00);
   Write_Command(0xD5);        //Set Display Clock Divide Ratio/Oscillator Frequency
   Write_Command(0x28);
```

```
    Write_Command(0xD8);        //Set Discharge Period
    Write_Command(0x02);
    Write_Command(0xD9);        //Set Pre-charge Period
    Write_Command(0x10);
    Write_Command(0x94);        //Set Pre-charge Period
    Write_Command(0x10);
    Write_Command(0x4B);        //Set Pre-charge Period
    Write_Command(0x33);
    Write_Command(0xDA);        //Set SEG Pads Hardware Configuration
    Write_Command(0x00);
    Write_Command(0xDB);        //Set VCOM Deselect Level
    Write_Command(0x30);
    Write_Command(0xDC);        //Set Row non-overlap
    Write_Command(0x00);
    Write_Command(0xDD);        //Pre-charge VSEGH Level control
    Write_Command(0x14);
    Clear_Screen();
    Write_Command(0xAF);        //Set Display On
}
```

11 Package Specification

Controlled Seal

Packing Process(1) ~ (9)

(1) Tray Type:0342O-MT5-A
Display face up

(2)
② 180° revers
① normal
TRAY

(3) order①、②、①、②
fix trays with tape
588 pcs of 1 small carton
1 tray contain 28 pcs
21 contained trays, 1 empty tray

(4) Use vaccum bag to package the tray and add 5 bags of desiccant into the vacuum bag
*5

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

(6)
EPE

(7)
RoHS MARK
small carton package

(8)
RoHS MARK
2 small cartons in 1 big carton

(9) 42 contained trays, 2 empty trays,
Package quantity products:
1176 pcs of 1 big carton
RoHS标识
苏州清越光电科技股份有限公司
Package finished

NOTE:1、The inner carton and master carton must be sealed with adhesive tape.

2、Fill up the gap with 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.

12 Reliability

12.1 Reliability Test

NO.	ITEM	CONDITION	QUANTITY
1	High Temperature (Non-operation)	85℃,240h	5
2	Low Temperature (Non-operation)	-40℃,240h	5
3	High Temperature (Operation)	70℃,240h	5
4	Low Temperature (Operation)	-40℃,240h	5
5	High Temperature / High Humidity (Operation)	60℃,90%RH,240h	5
6	Thermal shock (Non-operation)	-40 ℃ ~85 ℃ (-40 ℃ /30min;transit/5min;85 ℃ /30min;transit/5min) 1cycle: 70min,30cycles	5
7	ESD Air discharge (Non-operation)	±8kV, Test 9 point; Each point discharge 10 times. Time interval is not less than 1 second.	5

Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability, the stable time is at least 15 minutes.
2. The degradation of polarizer is ignored for item 5.
3. The tolerance of temperature is ±3℃, and the tolerance of relative humidity is ±5%.

Evaluation criteria

1. The function test is OK.
2. No observable defects.
3. Luminance:≥50% of initial value.
4. Current consumption: within ±50% of initial value.

12.2 Lifetime

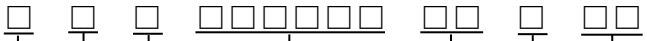
End of lifetime is specified as 50% of initial brightness and the test pattern at operating condition is 50% alternating checkerboard.

ITEM	MIN	MAX	UNIT	CONDITION
Operation Life Time	TBD	-	h	120 cd/m^2, 50% alternating checkerboard, 22±3℃, 55±15% RH

12.3 Failure Check Standard

After the completion of the described reliability test, the samples were left at room temperature for 2 hrs prior to conducting the failure test at 22±3℃; 55±15% RH.

13 Illustration of OLED Product Name



Flow No. :

01~99

Display Color :

R—red

G—green

B—blue

Y—yellow

W—white

A—area color

F—full color

M—amber

Panel Flow No. :

A0~A9, B0~B9…Z0~Z9

Display Format :

Graphic—columns and rows

Character—characters and line number

Segment—segment number

Product Type :

P—panel

M—module

Display Type :

G—graphic

C—character

S—segment

I—Icon

M—mixed

Company :

V—QingYue

14 Outgoing Quality Control Specifications

14.1 Sampling Method

(1) GB/T 2828.1/ISO2859-1: inspection level Ⅱ, normal inspection, single sample inspection

(2) AQL: Major 0.65; Minor 1.0

14.2 Inspection Conditions

The environmental conditions for test and measurement are performed as follows.

Temperature: 22±3°C

Humidity: 55±15%R.H

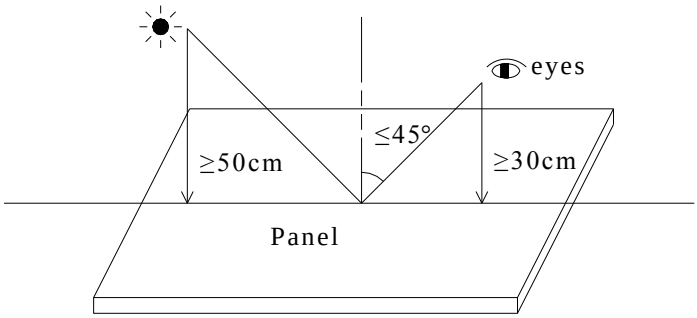
Fluorescent Lamp: 30W

Distance between the Panel & Lamp: ≥50cm

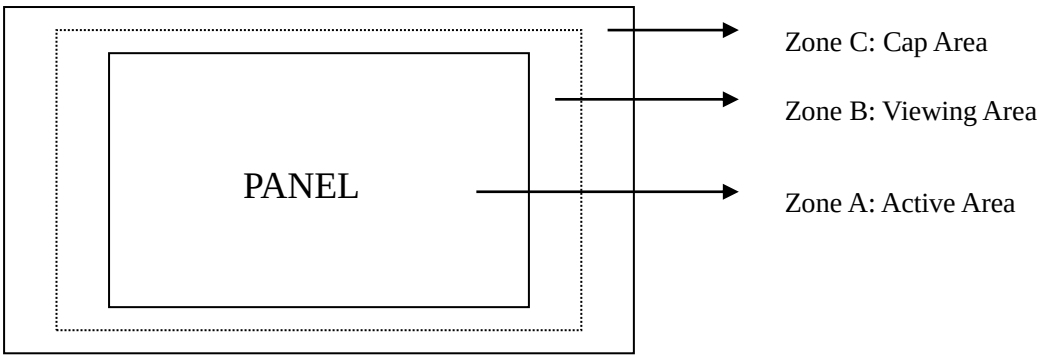
Distance between the Panel & Eyes: ≥30cm

Viewing angle from the vertical in each direction: ≤45°

(See the sketch below)

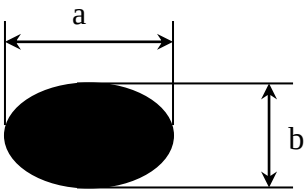


14.3 Quality Assurance Zones

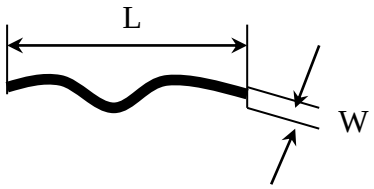


14.4 Inspection Standard

Definition of Φ&L&W (Unit: mm)

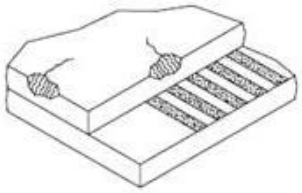
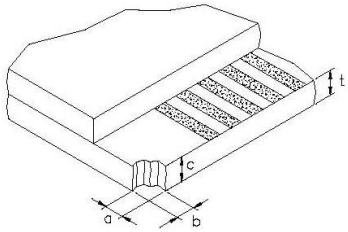
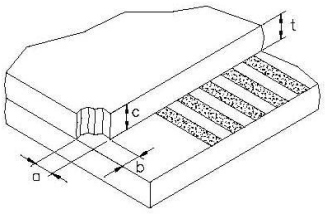
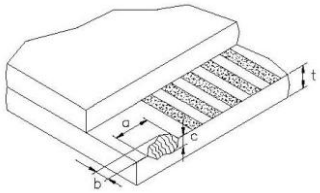
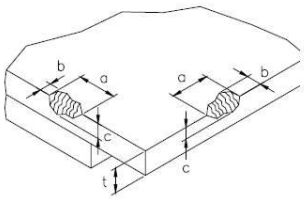
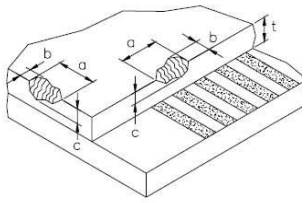


Φ=(a+b)/2



Ⅰ. Appearance Defects

<table>
<tr><th>NO.</th><th>ITEM</th><th>CRITERIA</th><th>CLASSIFICATION</th></tr>
<tr><td>1</td><td>Polarizer Black or White spot, Dirty spot, Foreign matter, Dent on the polarizer</td><td>
<table>
<tr><td rowspan="2">Average Diameter (mm)</td><td colspan="2">Acceptable Number</td></tr>
<tr><td>Zone A,B</td><td>Zone C</td></tr>
<tr><td>Φ≤0.15</td><td>Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.15<Φ≤0.30</td><td>3</td></tr>
<tr><td>Φ>0.30</td><td>0</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>2</td><td>Scratch/line on the glass/Polarizer</td><td>
<table>
<tr><td rowspan="2">Width (mm)</td><td rowspan="2">Length (mm)</td><td colspan="2">Acceptable Number</td></tr>
<tr><td>Zone A,B</td><td>Zone C</td></tr>
<tr><td>W≤0.05</td><td>---</td><td>Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.1</td><td>L≤5.0</td><td>3</td></tr>
<tr><td>W>0.1</td><td>---</td><td>0</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>3</td><td>Polarizer Bubble</td><td>
<table>
<tr><td rowspan="2">Average Diameter (mm)</td><td colspan="2">Acceptable Number</td></tr>
<tr><td>Zone A,B</td><td>Zone C</td></tr>
<tr><td>Φ≤0.2</td><td>Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.2<Φ≤0.5</td><td>3</td></tr>
<tr><td>Φ>0.5</td><td>0</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>4</td><td>Any Dirt & Scratch on Polarizer’s Protective Film</td><td>Ignore for not affect the polarizer.</td><td>Minor</td></tr>
<tr><td>5</td><td>Any Dirt on Cap Glass</td><td>Inside the Cap， Ignore the dirt without moving.</td><td>Minor</td></tr>
</table>

6	Glass Crack	 Propagation crack is not acceptable.	Major
7	Corner Chip	 t= Glass thickness Accept a≤2.0mm or b≤2.0mm, c≤t	Minor
8	Corner Chip on Cap Glass	 t= Glass thickness Accept a≤1.5mm or b≤1.5mm, c≤t	Minor
9	Chip on Contact Pad	 t= Glass thickness Accept a≤3.0mm or b≤0.8mm, c≤t (on the contact pin) a≤3.0mm or b≤1.5mm, c≤t (outside of the contact pin)	Minor
10	Chip on Face of Display	 t= Glass thickness Accept a≤1.5mm or b≤1.5mm, c≤t	Minor
11	Chip on Cap Glass	 t= Glass thickness Accept a≤3.0mm or b≤3.0mm, c≤t/2 a≤1.5mm or b≤1.5mm, t/2≤c≤t	Minor
12	Stain on Surface	Stain removable by soft cloth or air blow is acceptable.	Minor
13	TCP/FPC Damage	(1) Crack, deep scratch, deep hole and deep pressure mark on the TCP/FPC are not acceptable. (2) Terminal lead twisted or broken is not allowable. (3) Copper exposed is not allowed by naked eye inspection.	Minor
14	Dimension Unconformity	Checking by mechanical drawing.	Major

Ⅱ. Displaying Defects

<table>
<tr><th>NO.</th><th>Items</th><th>Criteria</th><th>Classification</th></tr>
<tr><td>1</td><td>Black/White spot
Dirty spot
Foreign matter</td><td>
<table>
<tr><td rowspan="2">Average Diameter (mm)</td><td colspan="2">Pieces Permitted</td></tr>
<tr><td>Zone A,B</td><td>Zone C</td></tr>
<tr><td>Φ≤0.10</td><td>Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.10＜Φ≤0.20</td><td>3</td></tr>
<tr><td>Φ＞0.20</td><td>0</td></tr>
</table>
</td><td>Minor</td></tr>
<tr><td>2</td><td>No Display</td><td>Not allowable.</td><td>Major</td></tr>
<tr><td>3</td><td>Irregular Display</td><td>Not allowable.</td><td>Major</td></tr>
<tr><td>4</td><td>Missing Line
(row or column)</td><td>Not allowable.</td><td>Major</td></tr>
<tr><td>5</td><td>Abnormal Color</td><td>Refer to the SPEC.</td><td>Major</td></tr>
<tr><td>6</td><td>Luminance NG</td><td>Refer to the SPEC.</td><td>Major</td></tr>
</table>

15 Precautions for operation and Storage

15.1 Precautions for Operation

(1) Since OLED panel is made of glass, do not apply any mechanical shock or impact or excessive force to it when installing the OLED module. Any strong mechanical impact due to falling dropping etc. may cause damage (breakage or cracking).

(2) The polarizer on the OLED surface is made of soft material and is easily scratched. Please take most care when handing. When the surface of the polarizer of OLED Module is contaminated, please wipe it off gently by using moisten soft cloth with isopropyl alcohol, do not use water, ketone or aromatics. If there is saliva or water on the OLED surface, please wipe it off immediately.

(3) When handling OLED module, please be sure that the body and the tools are properly grounded. And do not touch I/O pins with bare hands or contaminate I/O pins, it will cause disconnection or defective insulation of terminals.

(4) Do not attempt to disassemble or process the OLED module.

(5) OLED module should be used under recommended operating conditions shown in the specification. Since the higher voltage leads to the shorter lifetime, be sure to use the specified operating voltage.

(6) Foggy dew, moisture condensation or water droplets deposited on surface and contact terminals will cause polarizer stain or damage, the deteriorated display quality and electrochemical reaction then leads to shorter life time and permanent damage to the module probably. Please pay attention to the environmental temperature and humidity.

(7) An afterimage is created by the difference in brightness between unused dot and the fixed dot, according to the decrease of brightness of the emitting time. Therefore, to avoid having an afterimage, the full set should be thoroughly used instead of using a fixed dot. When the fixed dot emits, an afterimage can be created.

(8) Flicker could be come out at full on display. And it disappears when frame frequency increase, but brightness decreases too.

15.2 Soldering

(1) Soldering should be performed only on the I/O terminals.

(2) Use soldering irons with proper grounding and no leakage.

(3) Iron:The temperature setting of electric iron is 350℃, but we suggest that during soldering, the tem perature of iron tip should be no higher than 330℃ and soldering be finished within 3~4 seconds.

15.3 Precautions for Storage

(1) Please store OLED module in a dark place. Avoid exposure to sunlight, the light of fluorescent lamp or any ultraviolet ray.

(2) Keep the environment temperature between 10℃ and 35℃ and the relative humidity less than 70%. Avoid high temperature and high humidity.

(3) Keep the OLED modules stored in the container when shipped from supplier before using them is recommended.

(4) Do not leave any article on the OLED module surface for an extended period of time.

15.4 Warranty period

QingYue warrants for a period of 12 months from the shipping date when stored or used under normal condition. In addition to failure and quality problems caused by man-made damage and force majeure, we promise to provide maintenance and replacement free of charge during the warranty period. If the warranty period has been exceeded, we need to collect the staff's travel expenses, materials and other related costs.