Product Specification

（Common Application）

Product Name: VGM160128A9W02

Product Code: M05000

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.	2022-09-05	

1 Application filed

Common Application

2 Overview

VGM160128A9W02 is a gray−scale OLED display module with 160×128 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.

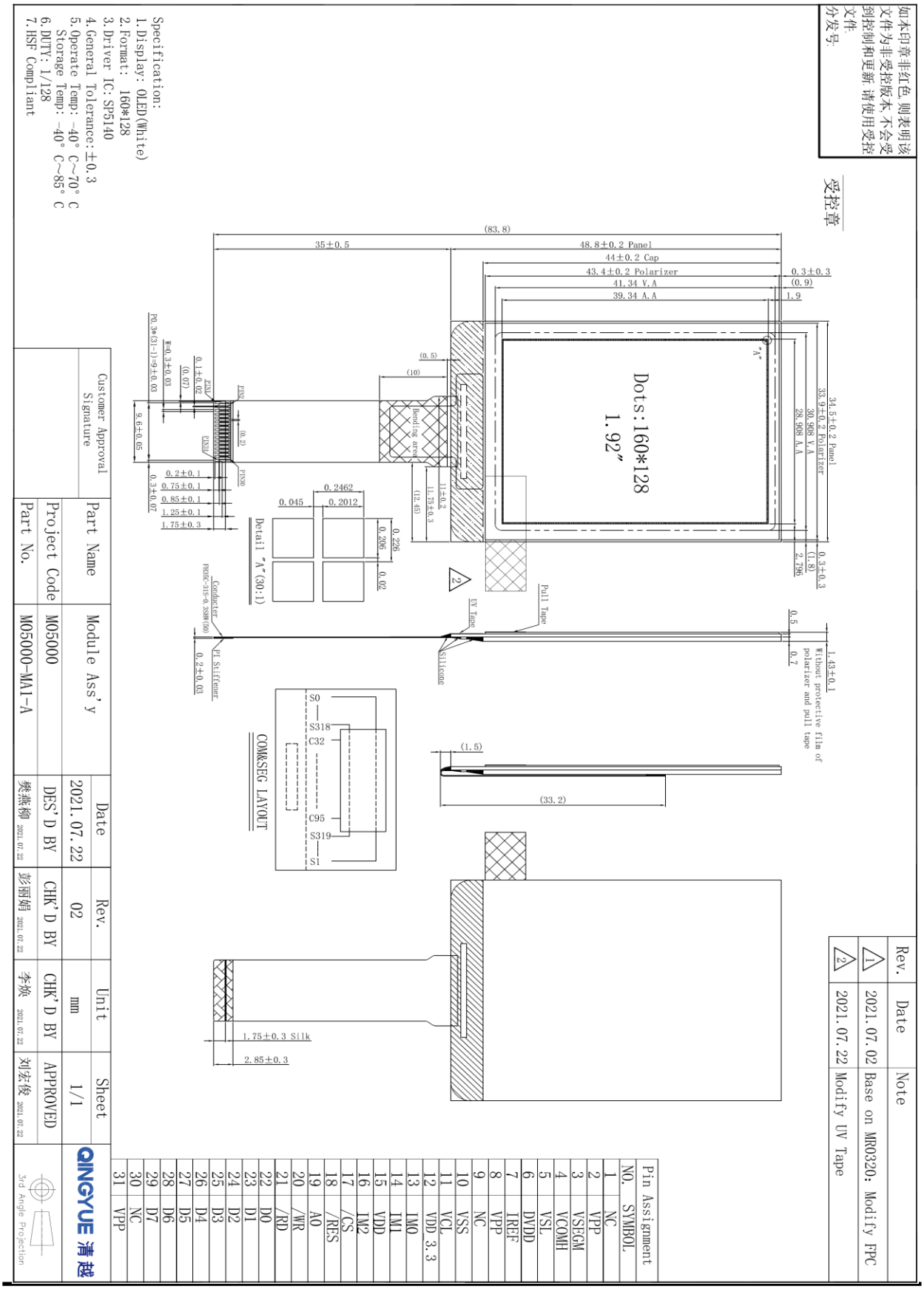
3 Features

- Display Color: White
- Dot Matrix:160×128
- Driver IC: SP5140
- Interface: 8-bit 8080,8-bit 6800, 3-wire SPI, 4-wire SPI,I℃
- 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	128(W)×160(H)	-
2	Dot Size	0.206(W)×0.2012(H)	mm^2
3	Dot Pitch	0.226(W)×0.2462(H)	mm^2
4	Aperture Rate	74.5	%
5	Active Area	28.908(W)×39.34(H)	mm^2
6	Panel Size	34.5(W)×48.8(H) ×1.20(T)	mm^3
7	Module Size	34.5(W)×83.8(H) ×1.43(T)	mm^3
8	Diagonal A/A Size	1.92	inch
9	Module Weight	TBD±10%	g

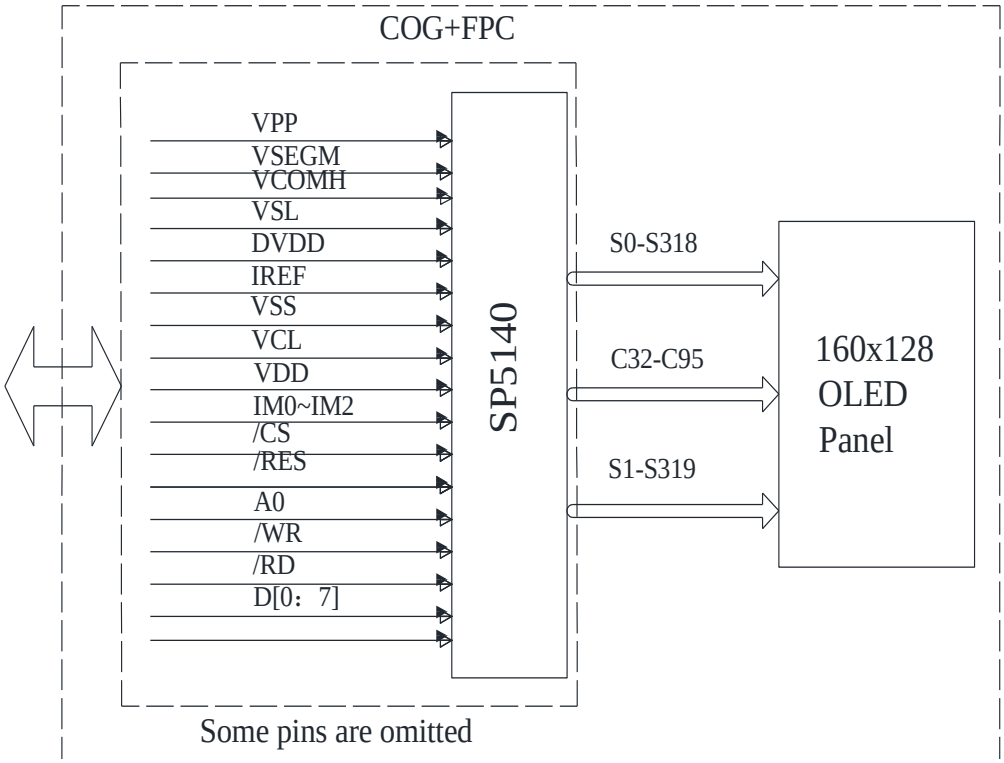
5 Mechanical Drawing



6 Module Interface

<table>
<tr><th>PIN NO.</th><th>PIN NAME</th><th>DESCRIPTION</th></tr>
<tr><td>1,9,30</td><td>NC</td><td>No Connection.</td></tr>
<tr><td>2,8,31</td><td>VPP</td><td>This is the most positive voltage supply pad of the chip
It should be supplied externally</td></tr>
<tr><td>3</td><td>VSEGM</td><td>This is a segment pre-charge voltage.
A 4.7uF capacitor can be connected between this pad and GND.</td></tr>
<tr><td>4</td><td>VCOMH</td><td>This is a pad for the voltage output high level for common signals.
A 4.7uF capacitor should be connected between this pad and GND.</td></tr>
<tr><td>5</td><td>VSL</td><td>Discharge voltage level pad.
A 4.7uF capacitor should be connected between this pad and GND.</td></tr>
<tr><td>6</td><td>DVDD</td><td>This pin is for regulator circuit.
A 4.7uF capacitor should be connected between this pad and GND.</td></tr>
<tr><td>7</td><td>IREF</td><td>This is a segment current reference pad. A resistor should be connected between this pad and GND.</td></tr>
<tr><td>10</td><td>VSS</td><td>Ground for analog, logic &buffer respectively.</td></tr>
<tr><td>11</td><td>VCL</td><td>This is a common voltage reference pad. This pad should be connected to VSS externally</td></tr>
<tr><td>12,15</td><td>VDD_3.3</td><td>1.65 - 3.5V power supply input pad for logic.</td></tr>
<tr><td>13
14
16</td><td>IM0
IM1
IM2</td><td>These are the MPU interface mode select pads.
<table>
<tr><th>IM[0:2]</th><th>8080</th><th>I^{2}C</th><th>6800</th><th>4-SPI</th><th>3-SPI</th></tr>
<tr><td>IM0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>IM1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>IM2</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
</table></td></tr>
<tr><td>17</td><td>/CS</td><td>This pad is the chip select input. These pins must be connected to “H” or “L”.</td></tr>
<tr><td>18</td><td>/RES</td><td>This is a reset signal input pad. These pins must be connected to “H” or “L”.</td></tr>
<tr><td>19</td><td>A0</td><td>This is the Data/Command control pad that determines whether the data bits are data or a command. A0 = “H”: the inputs at D0 to D7 are treated as display data.
A0 = “L”: the inputs at D0 to D7 are transferred to the command registers.
In I^{2}C interface, this pad serves as SA0 to distinguish the different address of OLED driver. These pins must be connected to “H” or “L”.</td></tr>
<tr><td>20</td><td>/WR</td><td>This is a MPU interface input pad.
When connected to an 8080 MPU, this is active LOW. This pad connects to the 8080 MPU /WR signal. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When /WR = “H”: Read. When /WR = “L”: Write.</td></tr>
<tr><td>21</td><td>/RD</td><td>This is a MPU interface input pad.
When connected to an 8080 series MPU, it is active LOW. This pad is connected to the /RD signal of the 8080 series MPU, and the data bus is in an output status when this signal is “L”. When connected to a 6800 series MPU, this is active HIGH. This is used as an enable clock input of the 6800 series MPU.</td></tr>
<tr><td>22~29</td><td>D0~D7</td><td>This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected, then D0 serves as the serial clock input pad (SCL) and D1serves as the serial data input pad (SI). When reading, D2 can be select as data output pad. D2(3) to D7 are set to high impedance.
When the I^{2}C interface is selected, then D0 serves as the serial clock input pad (SCL) and D1 serves as the serial data input pad (SDA). At this time, D2 to D7 are set to high impedance.</td></tr>
</table>

7 Function Block Diagram



8 Absolute Maximum Ratings

ITEM	SYMBOL	MIN	MAX	UNIT	REMARK
Supply voltage	VDD	-0.3	3.6	V	IC maximum rating
	VPP	-0.3	18.5	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	TYP	MAX	UNIT
Operating Voltage	VPP	-	10.7	11.0	11.3	V
Logic Supply Voltage	VDD	-	1.65	-	3.5	V
High-level Output voltage	V_{OHC}	I_{oH}=-0.5mA(D0-D7)	0.8×VDD	-	VDD	V
Low-level Output voltage	V_{OLC}	I_{oL}=0.5mA(D0,D2-D7)	VSS	-	0.2×VDD	V
High Logic Input voltage	V_{IHC}	A0, D0 - D7, RD, WR, CS, IM0~2 and RES .	0.8×VDD	-	VDD	V
Low Logic Input voltage	V_{ILC}		VSS	-	0.2×VDD	V

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

9.2 Electro-optical Characteristics

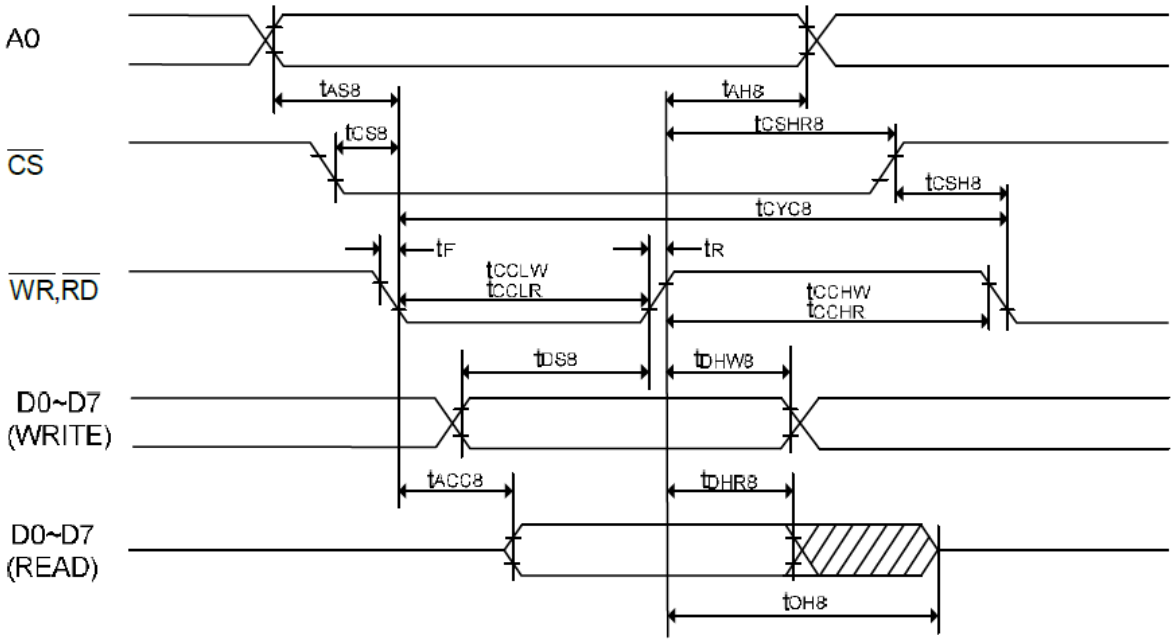
ITEM	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Normal Mode Brightness (with polarizer)	L_{br}	All pixels ON(1)	180	230	-	cd/m^2
VDD Sleep mode Current	ISP_VDD	During sleep, TA = +25℃, VDD = 3V, 500us after pin reset	-	0.02	120	uA
VPP Sleep mode Current	ISP_VPP	During sleep, TA = +25℃, VPP = 12V	-	0.02	10	uA
Normal Mode Power Consumption	Pt	All pixels ON(1)	682	880	-	mW
C.I.E(White)	(x)	x,y(CIE1931)	0.32	0.36	0.40	-
	(y)		0.34	0.38	0.42	-
Dark Room Contrast	CR	-	10000:1	-	-	-
Response Time	-	-	-	10	-	μs
View Angle	-	-	＞160	-	-	Degree

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

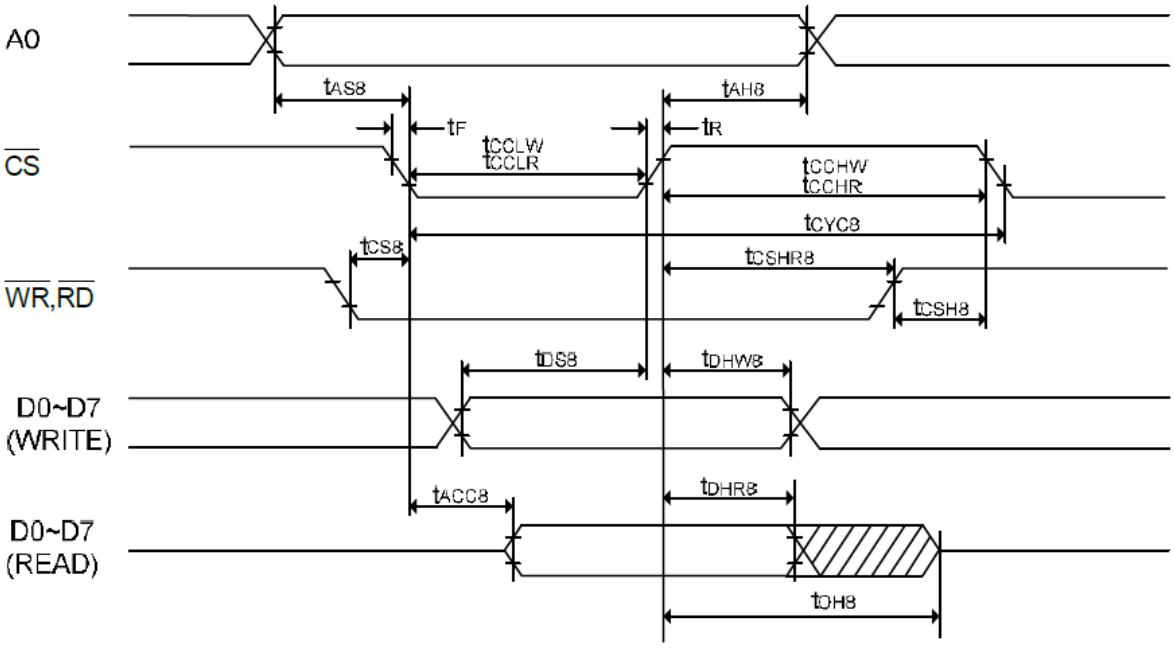
- Driving voltage: 11V
- Contrast setting: 0xD0
- Frame rate: 100 Hz
- Duty setting: 1/128

9.3 AC Electrical Characteristics

(1) System buses Read/Write characteristics 1 (For the 8080 Series Interface MPU)



8080-series parallel interface cycle (Form1)



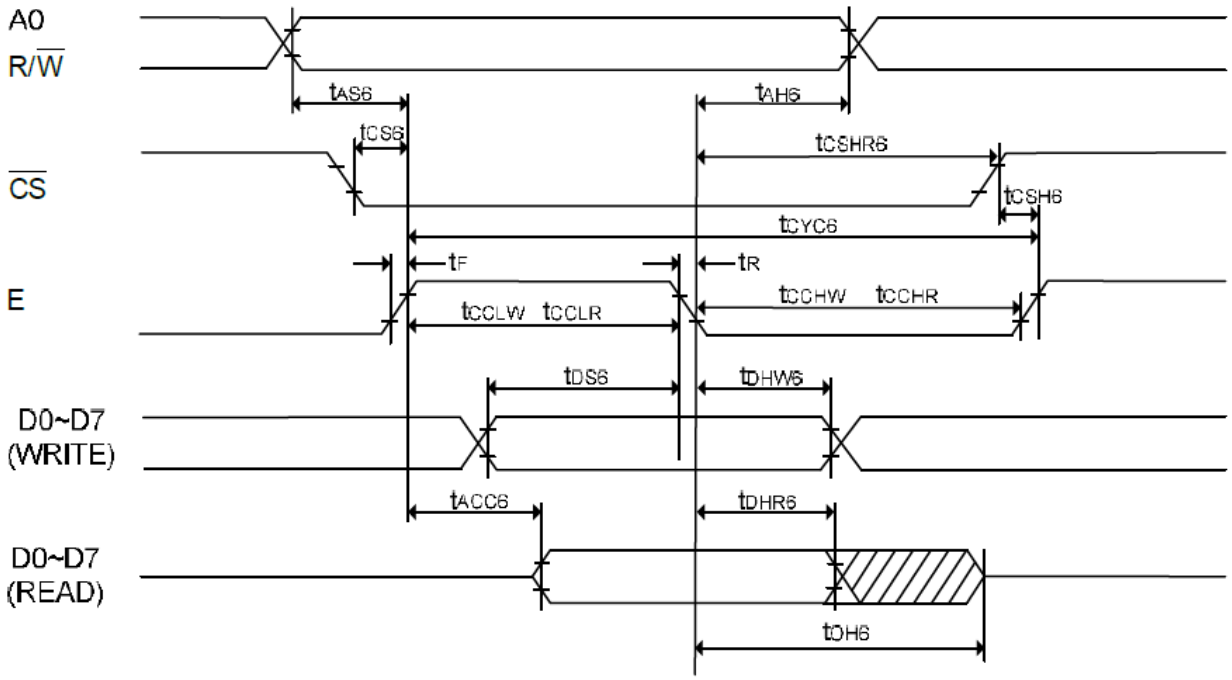
8080-series parallel interface cycle (Form2)

（VDD=1.65V~3.5V,T_A=+25℃）

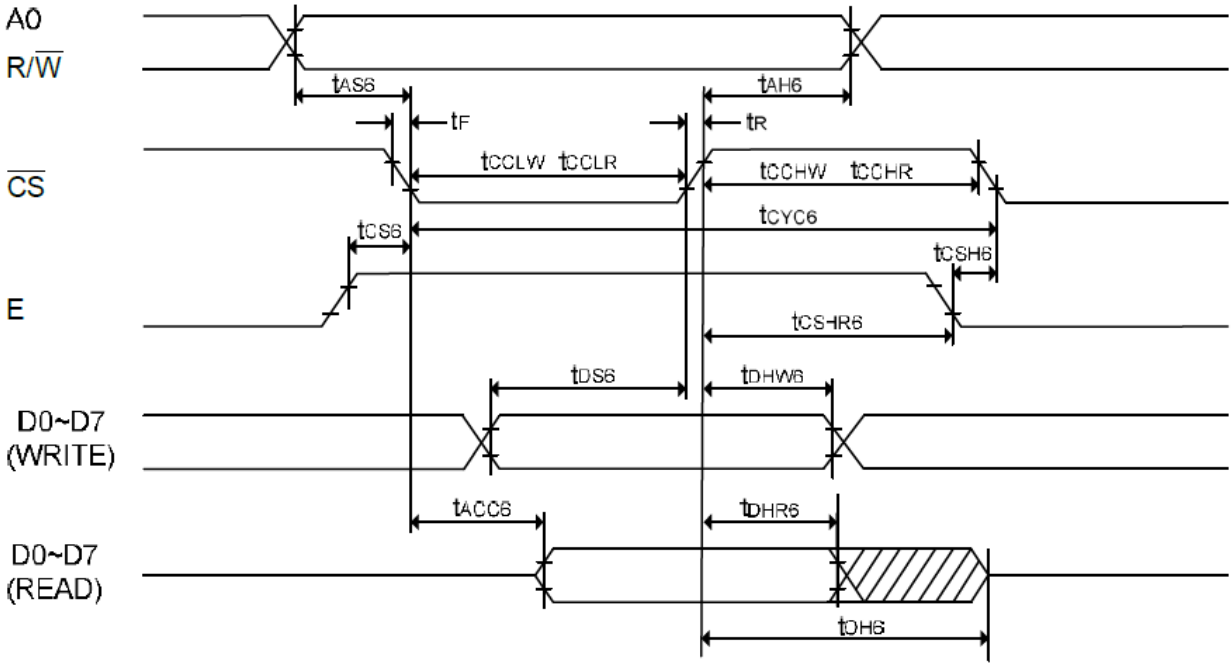
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{CYC8}	System cycle time	600	-	-	ns	
t_{AS8}	Address setup time	0	-	-	ns	
t_{AH8}	Address hold time	0	-	-	ns	
t_{DS8}	Data setup time	80	-	-	ns	
t_{DHW8}	Write Data hold time	20	-	-	ns	
t_{DHR8}	Read Data hold time	20	-	-	ns	
T_{OH8}	Output disable time	-	-	140	ns	C_L = 100pF
t_{ACC8}	$\overline{RD}$ access time	-	-	280	ns	C_L = 100pF
t_{CCLW}	Control L pulse width (WR)	300	-	-	ns	
t_{CCLR}	Control L pulse width (RD)	300	-	-	ns	
t_{CCHW}	Control H pulse width (WR)	300	-	-	ns	
t_{CCHR}	Control H pulse width (RD)	300	-	-	ns	
t_R	Rise time	-	-	30	ns	
t_F	Fall time	-	-	30	ns	
t_{CS8}	Chip select setup time	0	-	-	ns	
t_{CSH8}	Chip select hold time	40	-	-	ns	
t_{CSHR8}	Chip select hold time to read signal	40	-	-	ns	

Note: 8080 interface speed is less than oscillator frequency.

(2) System buses Read/Write characteristics 2 (For the 6800 Series Interface MPU)



6800-series parallel interface cycle (Form1)



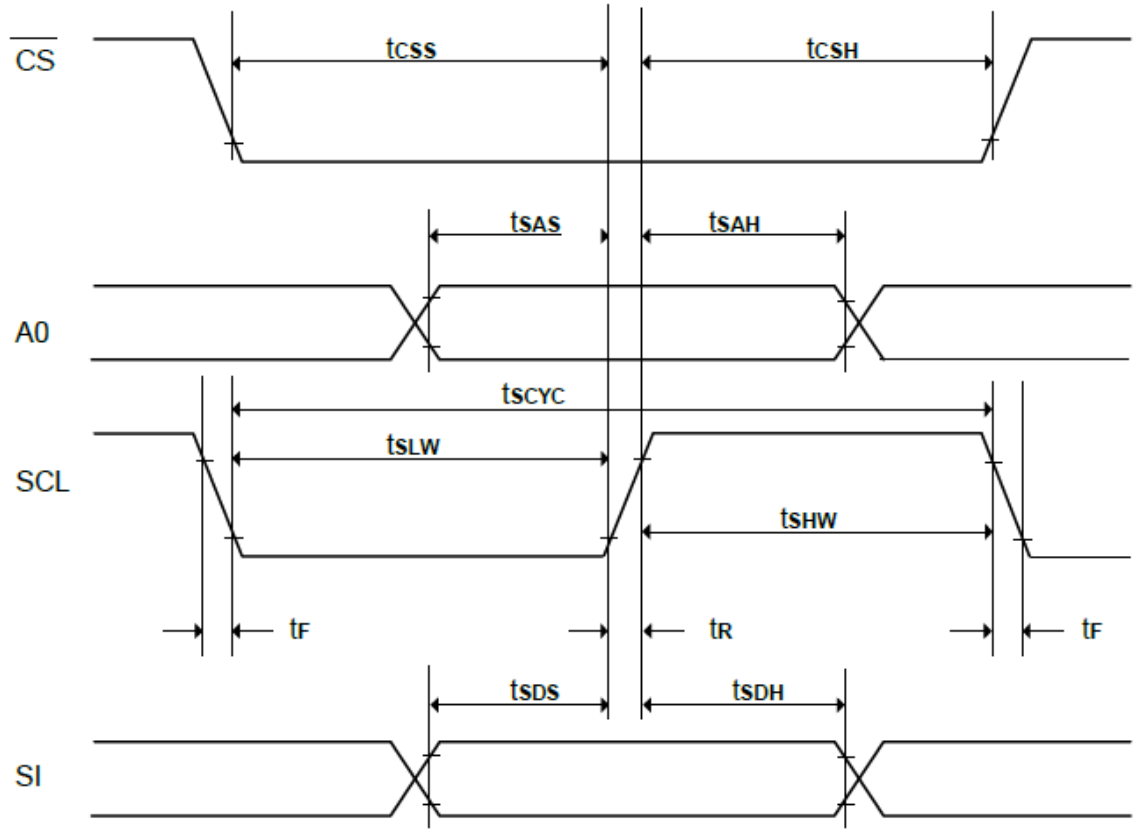
6800-series parallel interface cycle (Form2)

（VDD=1.65V~3.5V,T_A=+25℃）

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tCYC6	System cycle time	600	-	-	ns	
tAS6	Address setup time	0	-	-	ns	
tAH6	Address hold time	0	-	-	ns	
tDS6	Data setup time	80	-	-	ns	
tDHW6	Write Data hold time	20	-	-	ns	
tDHR6	Read Data hold time	20	-	-	ns	
tOH6	Output disable time	-	-	140	ns	CL = 100pF
tACC6	Access time	-	-	280	ns	CL = 100pF
tEWHW	Enable H pulse width (Write)	300	-	-	ns	
tEWHR	Enable H pulse width (Read)	300	-	-	ns	
tEWLW	Enable L pulse width (Write)	300	-	-	ns	
tEWLR	Enable L pulse width (Read)	300	-	-	ns	
tR	Rise time	-	-	30	ns	
tF	Fall time	-	-	30	ns	
tCS6	Chip select setup time	0	-	-	ns	
tCSH6	Chip select hold time	40	-	-	ns	
tCSHR6	Chip select hold time to read signal	40	-	-	ns	

Note: 6800 interface speed is less than oscillator frequency.

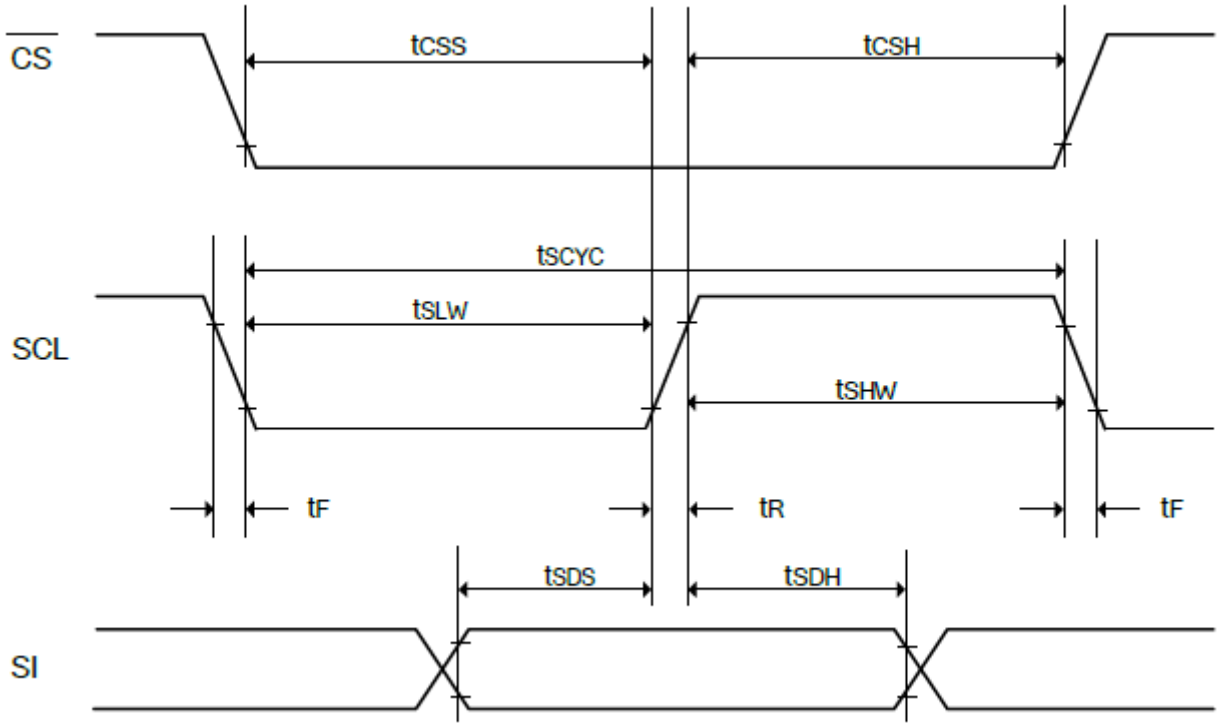
(3) System buses Read/Write characteristics 3 (For the 4-wire SPI Interface MPU)



（VDD=1.65V~3.5V,T_A=+25℃）

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tSCYC	Serial clock cycle	100	-	-	ns	
tSAS	Address setup time	60	-	-	ns	
tSAH	Address hold time	60	-	-	ns	
tSDS	Data setup time	40	-	-	ns	
tSDH	Data hold time	40	-	-	ns	
tCSS	$\overline{CS}$ setup time	90	-	-	ns	
tCSH	$\overline{CS}$ hold time time	24	-	-	ns	
tSHW	Serial clock H pulse width	40	-	-	ns	
tSLW	Serial clock L pulse width	40	-	-	ns	
tR	Rise time	-	-	6	ns	
tF	Fall time	-	-	6	ns	

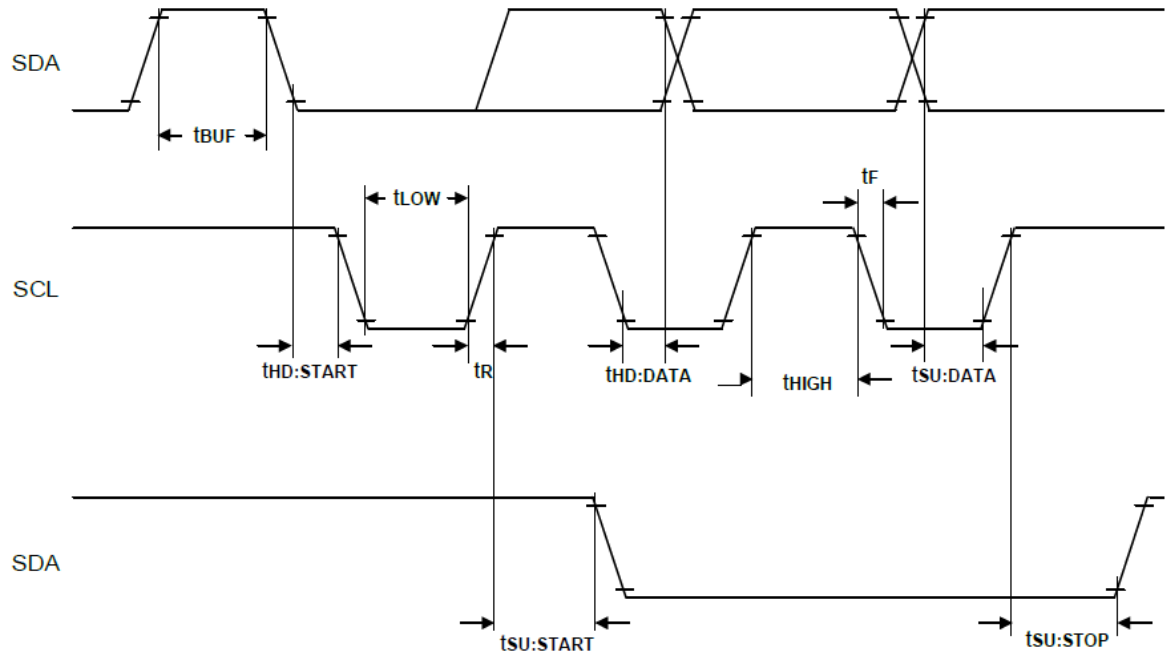
(4) System buses Read/Write characteristics 4 (For the 3-wire SPI Interface MPU)



（VDD=1.65V~1.8V,T_A=+25℃）

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
t_{SCYC}	Serial clock cycle	100	-	-	ns	
t_{SDS}	Data setup time	40	-	-	ns	
t_{SDH}	Data hold time	40	-	-	ns	
t_{CSS}	$\overline{CS}$ setup time	90	-	-	ns	
t_{CSH}	$\overline{CS}$ hold time time	24	-	-	ns	
t_{SHW}	Serial clock H pulse width	40	-	-	ns	
t_{SLW}	Serial clock L pulse width	40	-	-	ns	
t_R	Rise time	-	-	6	ns	
t_F	Fall time	-	-	6	ns	

(5) System buses Read/Write characteristics 5 (For the I^2C Interface MPU)



（VDD=1.65V~3.5V,T_A=+25℃）

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
fSCL	SCL clock frequency	0	-	400	kHz	
TLOW	SCL clock Low pulse width	1.3	-	-	uS	
THIGH	SCL clock H pulse width	0.6	-	-	uS	
TSU:DATA	data setup time	100	-	-	nS	
THD:DATA	data hold time	0(1)	-	0.9(2)	uS	
TR	SCL，SDA rise time	20	-	300	nS	
TF	SCL，SDA fall time	20	-	300	nS	
Cb	Capacity load on each bus line	-	-	400	pF	
TSU:START	Setup timefor re-START	0.6	-	-	uS	
THD:START	START Hold time	0.6	-	-	uS	
TSU:STOP	Setup time for STOP	0.6	-	-	uS	
TBUF	Bus free times between STOP and START condition	1.3	-	-	uS	

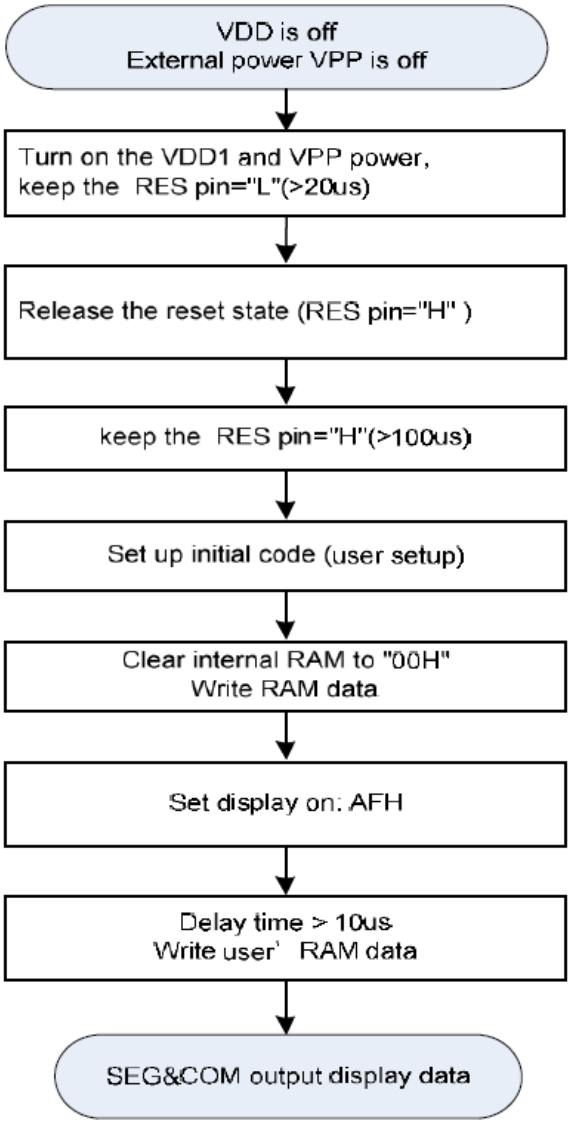
Notes

1. A device must internally provide a hold time of at least 300 ns for the SDA signal (referred to the VIHmin of the SCL signal) to bridge the undefined region of the falling edge of SCL.
2. The maximum tHD;DAT has only to be met if the device does not stretch the LOW period (tLOW) of the SCL signal.

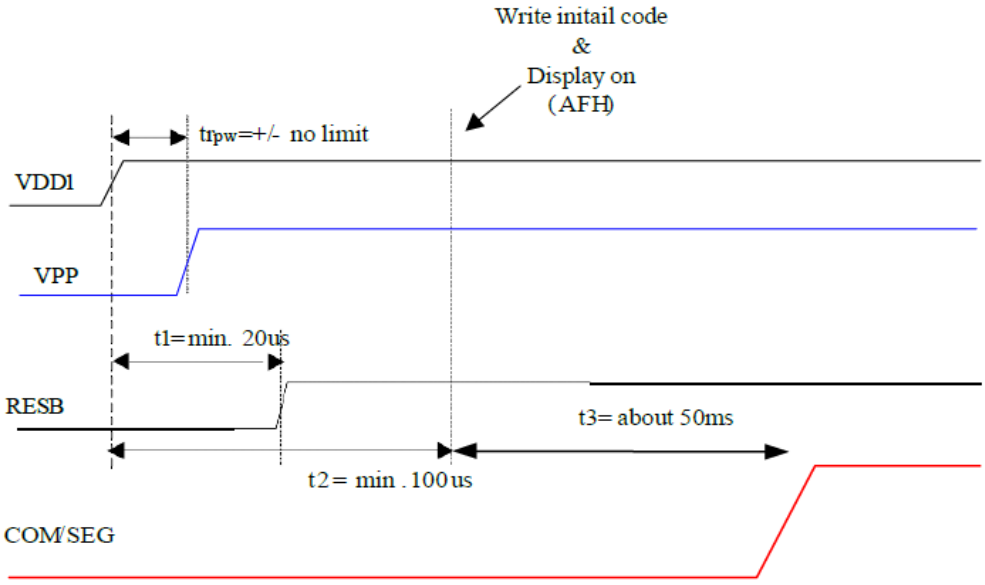
10 Functional Specification and Application Circuit

10.1 Power ON and Power OFF Sequence

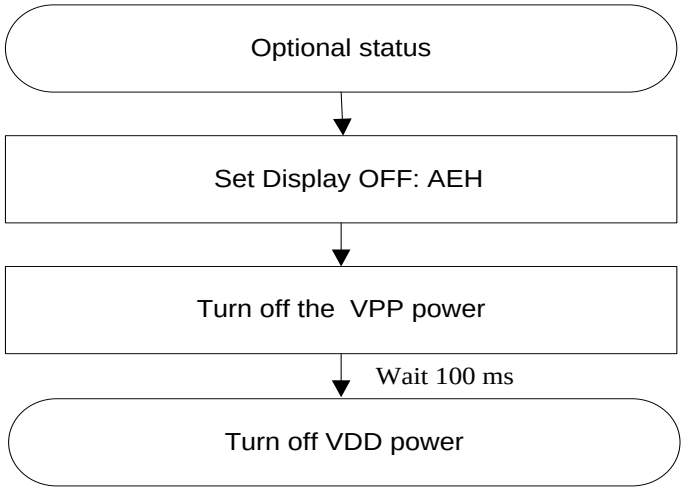
External power is being used immediately after turning on the power:



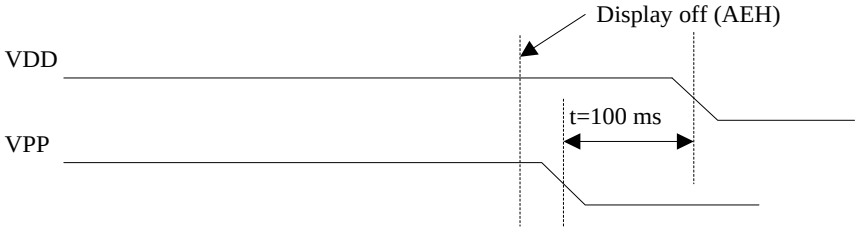
Power On Sequence:



Power OFF:



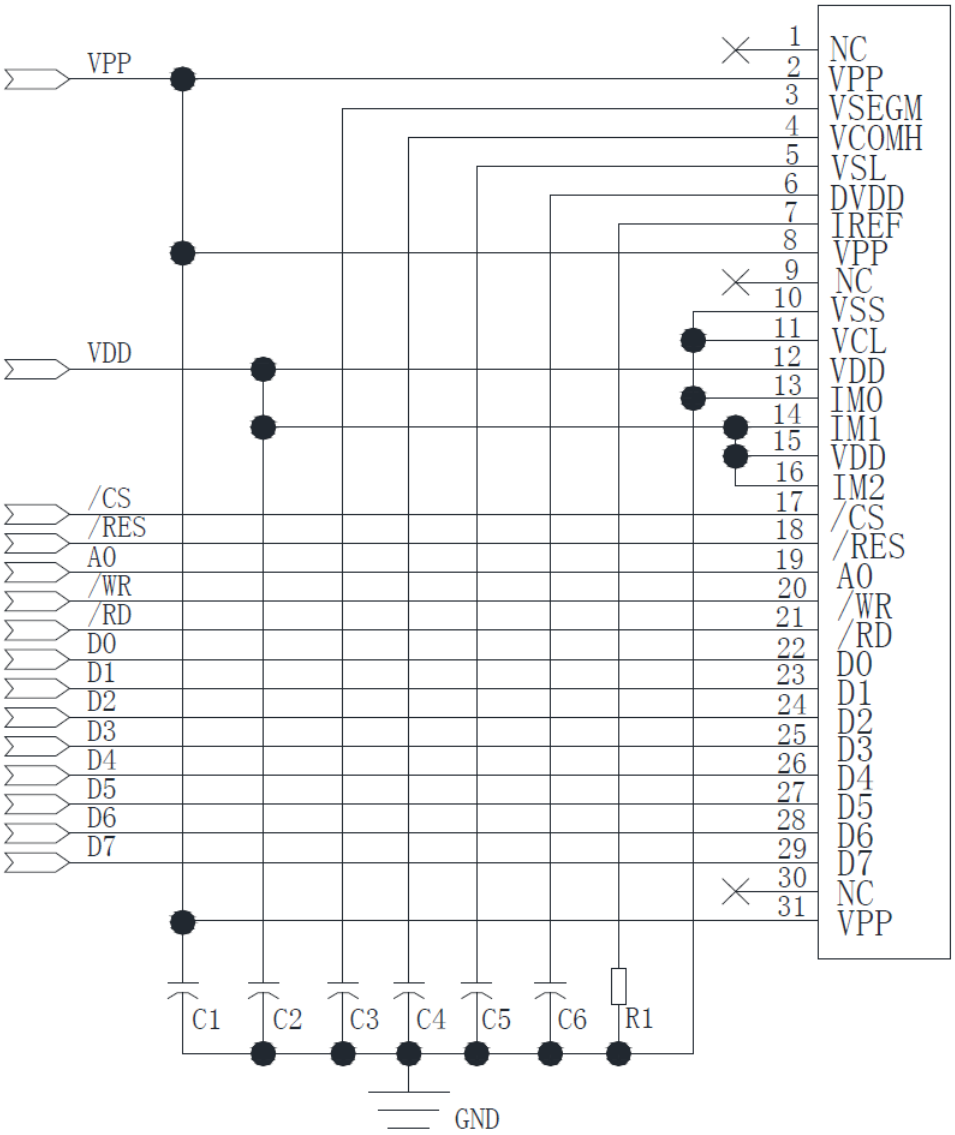
Power OFF Sequence:



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 8080-parallel interface mode, external VPP is shown in the following diagram:



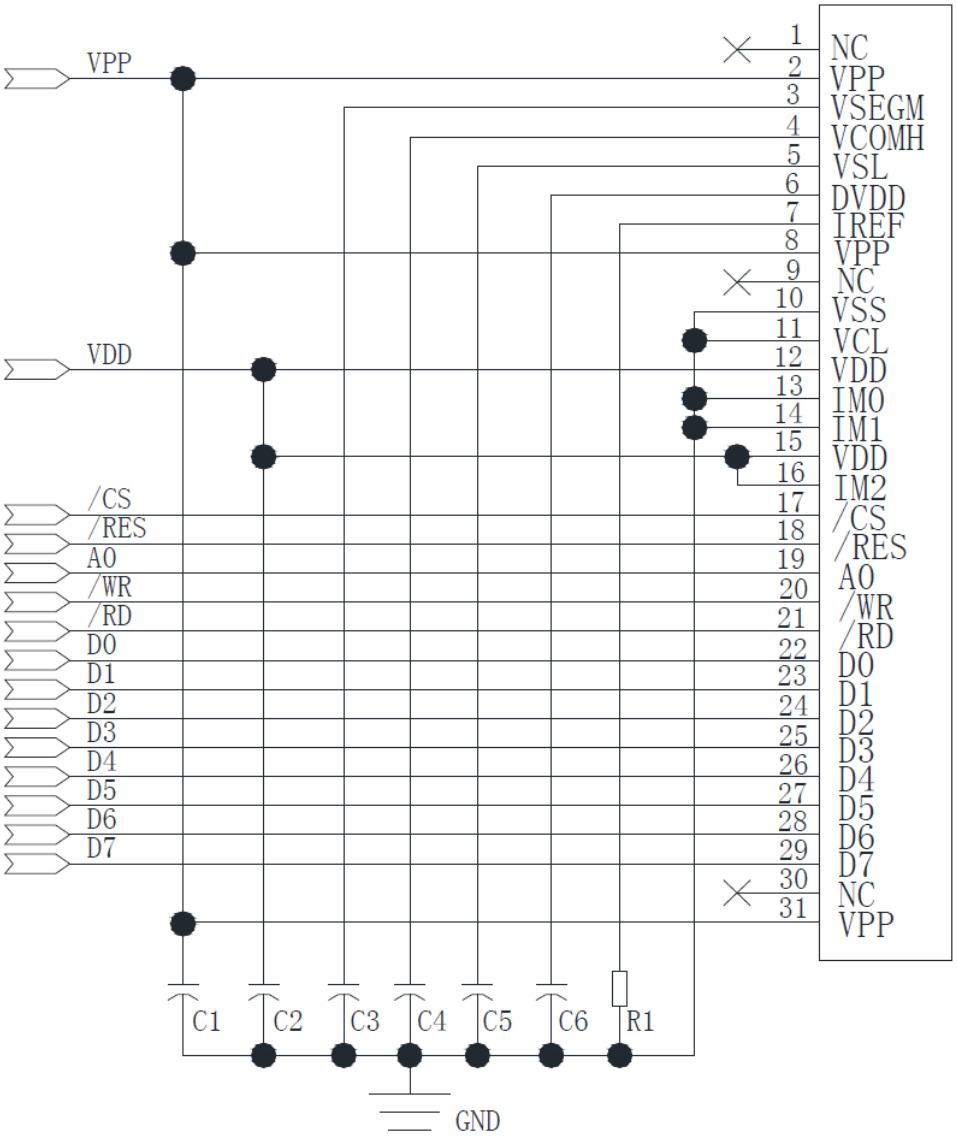
Pin connected to MCU interface: D[7:0],/RD,/WR,A0,/RES,/CS.

Recommended components

C1~ C6: 4.7μF/16V.RoHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 750KΩ.RoHS

10.2.2.The configuration for 6800-parallel interface mode, external VPP is shown in the following diagram:



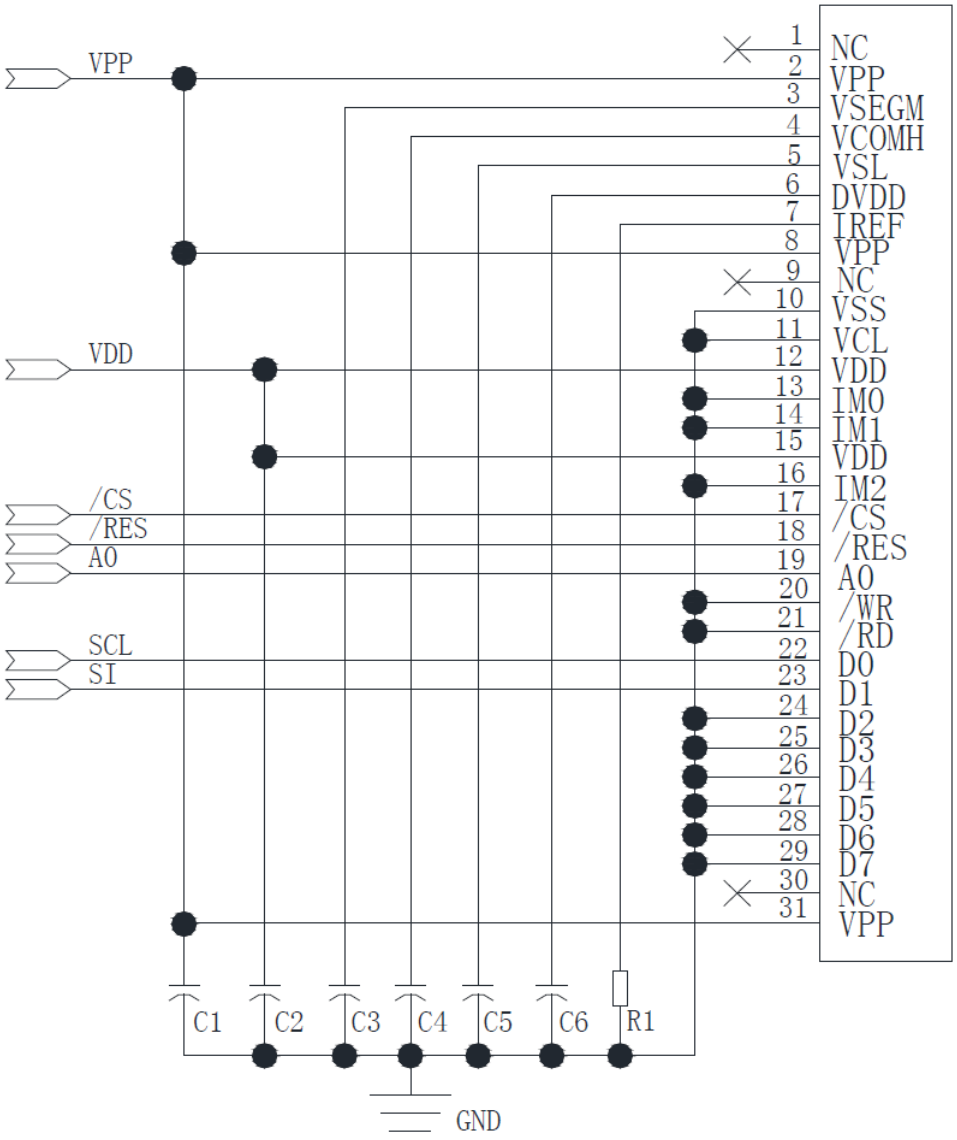
Pin connected to MCU interface: D[7:0],/RD, /WR ,A0,/RES,/CS.

Recommended components

C1~ C6: 4.7μF/16V.RoHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 750KΩ.RoHS.

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



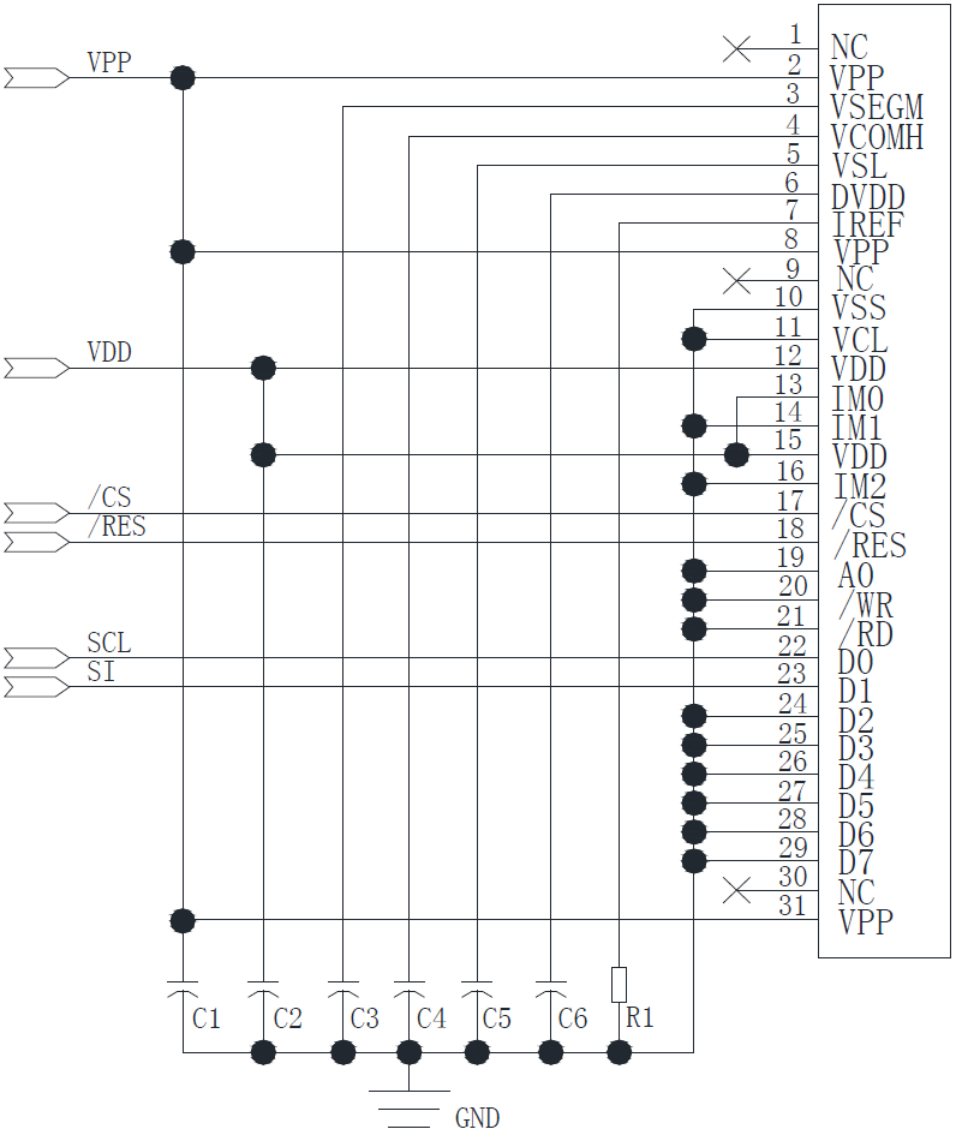
Pin connected to MCU interface: SI,SCL,/CS,A0,/RES.

Recommended components

C1~C6: 4.7μF/25V.RoHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 750KΩ.RoHS.

10.2.4.The configuration for 3-wire SPI interface mode, external VPP is shown in the following diagram:



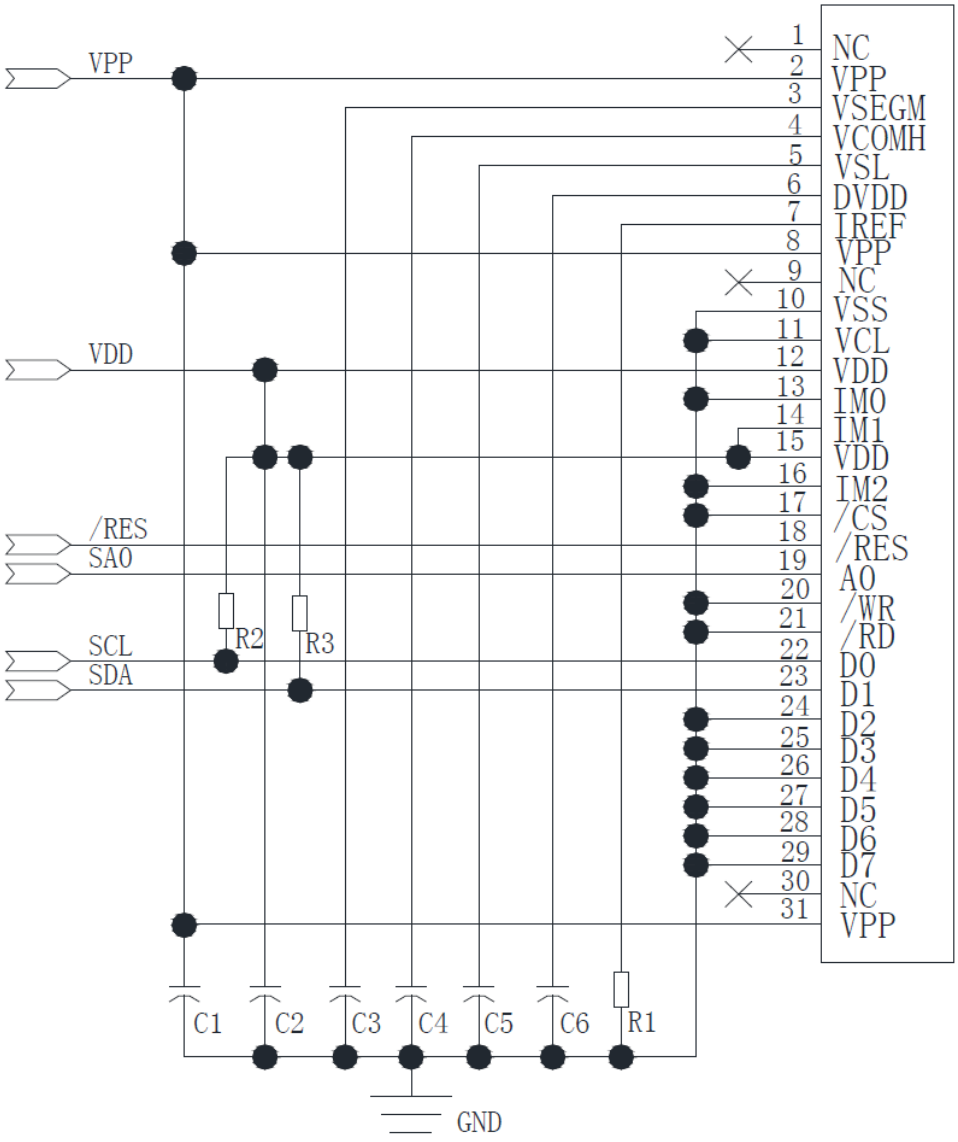
Pin connected to MCU interface: SI,SCL,/CS, /RES.

Recommended components

C1~C6: 4.7μF/25V.RoHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 750KΩ.RoHS

10.2.5.The configuration for I℃ interface mode, external VPP is shown in the following diagram:



Pin connected to MCU interface:SDA,SCL,SA0,/RES.

SA0	I² C Address
0	0x78
1	0x7A

Recommended components

C1~ C6: 4.7μF/25V.RoHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 750KΩ.RoHS

R2,R3: 0603 1/10W +/-5% 10KΩ.RoHS

10.3 Display Control Instruction

Refer to SP5140 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.

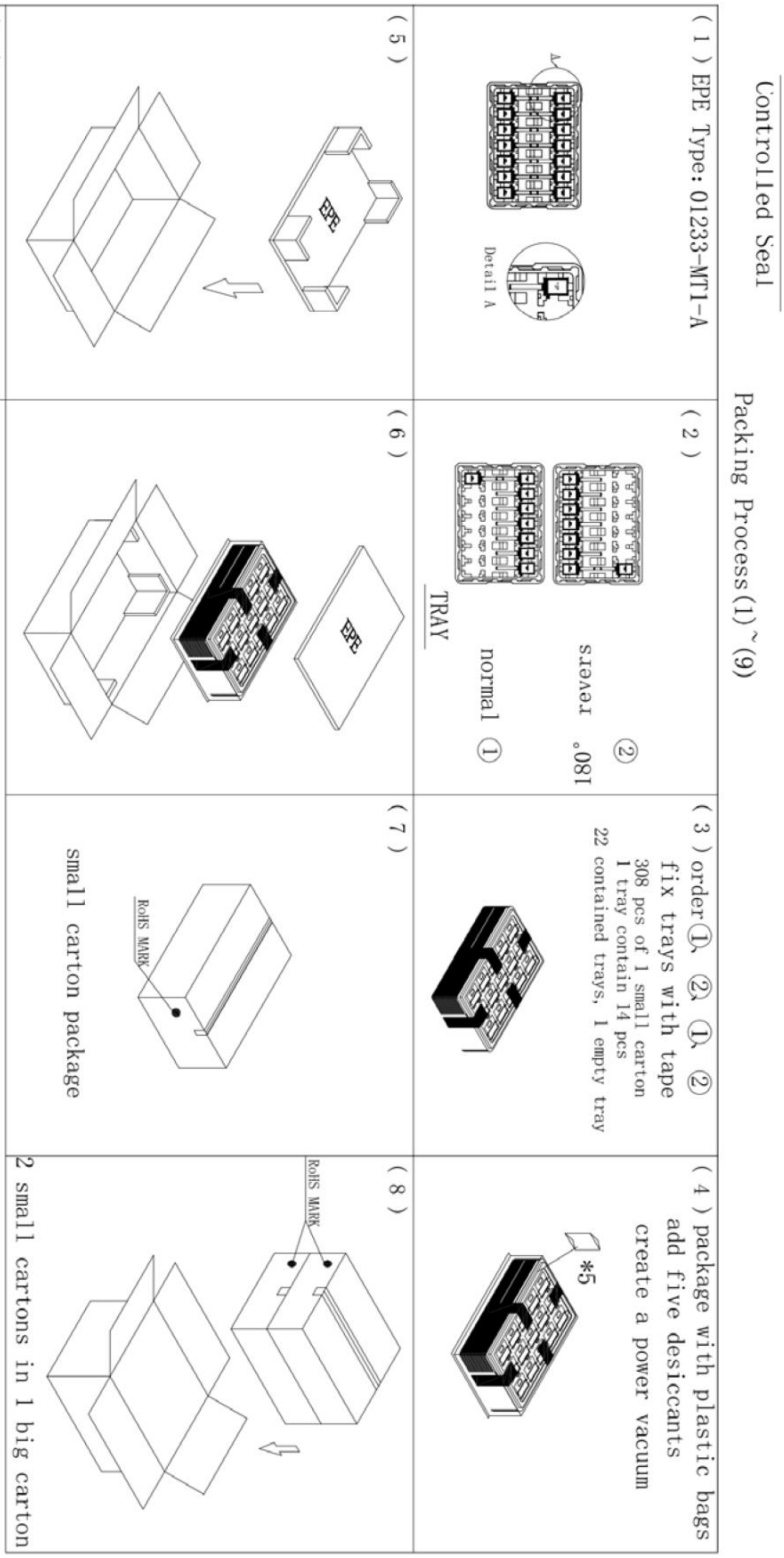
```
void Init_IC()
{
    Write_Command(0xAE);     //display off
    Write_Command(0x20);     //Horizontal addressing mode
    Write_Command(0x00);
    Write_Command(0x23);     //breath off
    Write_Command(0x00);
    Write_Command(0xA2);     //start line
    Write_Command(0x00);
    Write_Command(0x81);     //contrast
    Write_Command(0xD0);
    Write_Command(0xAD);     //external iref resistor
    Write_Command(0x00);
    Write_Command(0xA0);     //seg remap
    Write_Command(0xA4); //entire displai off
    Write_Command(0xAA); //black display off
    Write_Command(0xA6); //reverse display off
    Write_Command(0xA8);     //multi ratio
    Write_Command(0x3F);
    Write_Command(0xC0);     //com remap
    Write_Command(0xD3);     //display offset
    Write_Command(0x60);
    Write_Command(0xAC);     //gray mode
    Write_Command(0x00);
    Write_Command(0xD5);     //Oscillator Frequency
    Write_Command(0x51);
    Write_Command(0x48);     //discharge1
    Write_Command(0x00);
    Write_Command(0x93);     //discharge2
    Write_Command(0x00);
    Write_Command(0xD8);     //discharge3
```

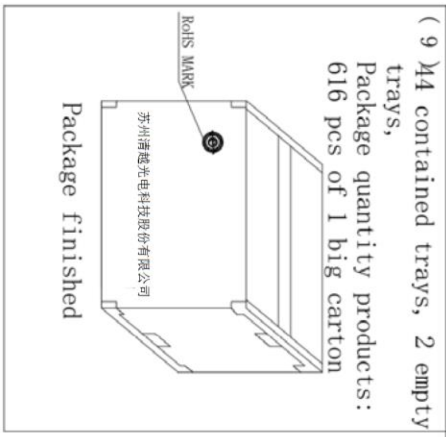
```
Write_Command(0x00);
Write_Command(0x49);    //precharge1
Write_Command(0x00);
Write_Command(0xD9);    //precharge2
Write_Command(0x00);
Write_Command(0x94);    //precharge3
Write_Command(0x1F);
Write_Command(0x4B);    //pwm start position
Write_Command(0x1E);
Write_Command(0xDA);    //pad configuration
Write_Command(0x00);
Write_Command(0xDB);    //vcomh:0.699*vpp
Write_Command(0x2A);
Write_Command(0xDC);    //vsegh:0.475*vpp
Write_Command(0x0F);
Write_Command(0xDD);    //vsl:0.20*vpp
Write_Command(0x01);
Write_Command(0x8C);//display effect1 on
Write_Command(0x80);
Write_Command(0x8D);//display effect1 parameter
Write_Command(30);
Write_Command(27);
Write_Command(24);
Write_Command(21);
Write_Command(18);
Write_Command(15);
Write_Command(13);
Write_Command(10);
Write_Command(7);
Write_Command(4);
Write_Command(1);
Write_Command(0x8A);//display effect2 on
Write_Command(0x80);
Write_Command(0x8B);//display effect2 parameter
Write_Command(0);
Write_Command(0);
Write_Command(0);
```

```
Write_Command(0);
Write_Command(63);
Write_Command(40);
Write_Command(20);
Write_Command(10);
Write_Command(63);
Write_Command(40);
Write_Command(20);
Write_Command(10);
Write_Command(63);
Write_Command(40);
Write_Command(20);
Write_Command(10);
Write_Command(63);
Write_Command(40);
Write_Command(20);
Write_Command(10);
Write_Command(63);
Write_Command(40);
Write_Command(20);
Write_Command(10);
Write_Command(63);
Write_Command(40);
Write_Command(20);
Write_Command(10);
Write_Command(63);
Write_Command(40);
Write_Command(20);
Write_Command(10);
Write_Command(63);
Write_Command(40);
Write_Command(20);
Write_Command(10);
```

```
        Write_Command(63);
        Write_Command(40);
        Write_Command(20);
        Write_Command(10);
        Write_Command(63);
        Write_Command(40);
        Write_Command(20);
        Write_Command(10);
        Write_Command(63);
        Write_Command(40);
        Write_Command(20);
        Write_Command(10);
        Write_Command(63);
        Write_Command(40);
        Write_Command(20);
        Write_Command(10);
        Write_Command(63);
        Write_Command(40);
        Write_Command(20);
        Write_Command(10);
        Write_Command(63);
        Write_Command(40);
        Write_Command(20);
        Write_Command(10);
        Write_Command(0xEF);     //interal DVDD cap
        Write_Command(0x00);
        Write_Command(0xAF);
    }
```

11 Package Specification





NOTE:1、The inner carton and master 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.

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. High temperature storage tests ignore polarizer changes.
2. No observable defects.
3. Luminance:≥50% of initial value.
4. Current consumption: within ±50% of initial value.

12.2 Lifetime

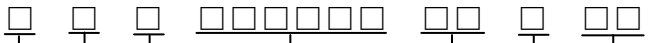
End of lifetime is specified as 50% of initial brightness and the test pattern at operating condition is 50% alternating checkerboard.

ITEM	MIN	MAX	UNIT	CONDITION
Operation Life Time	10,000	-	h	230 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

Mixed—pixel 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

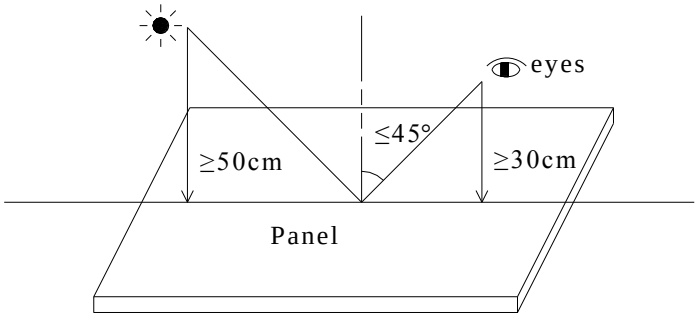
Fluorescent Lamp: 30W

Distance between the Panel & Lamp: ≥50cm

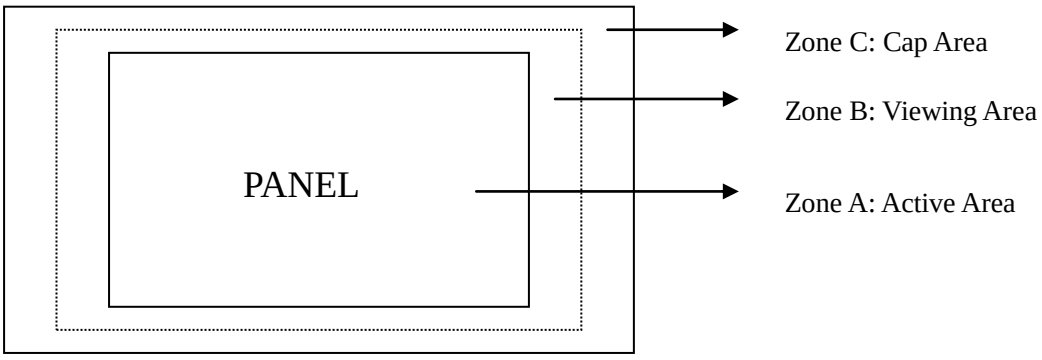
Distance between the Panel & Eyes: ≥30cm

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

(See the sketch below)

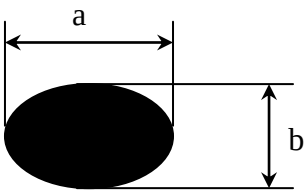


14.3 Quality Assurance Zones

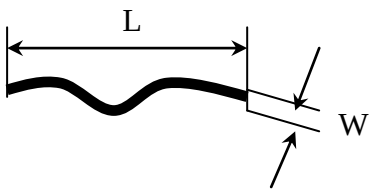


14.4 Inspection Standard

Definition of Φ&L&W (Unit: mm)

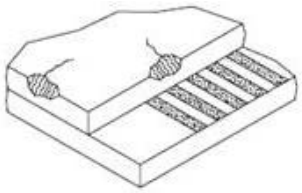
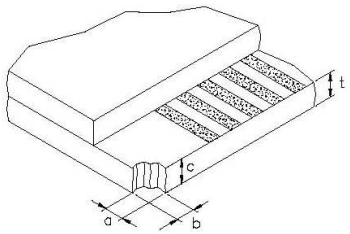
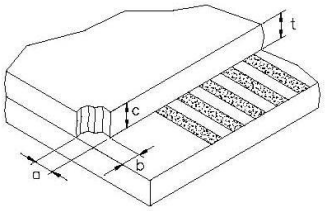
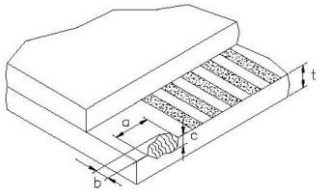
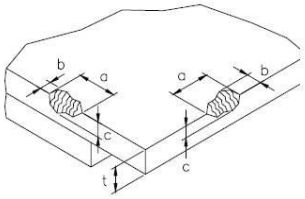
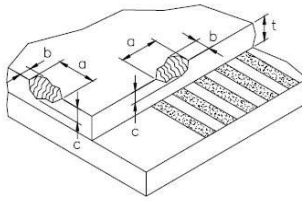


Φ=(a+b)/2



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</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≤3.0 mm or b≤0.8mm, c≤t (on the contact pin) a≤3.0 mm or b≤2.0mm, 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

Qing Yue 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.