Product Specification

(Common Application)

Product Name: VGM256128A0W02

Product Code: M01161

Customer
Approved by Customer
Approved Date:

Designed By	Checked By	Approved By	
		R&D	QA

CONTENT

REVISION RECORD

REV.	REVISION DESCRIPTION	REV. DATE	REMARK
D01	Initial release.	2015-07-06	
D02	Update Electro-optical Characteristics	2015-07-13	Page 10
A01	Update Mechanical Drawing Remove External DC-DC application circuit Update Reliability Modify “Visionox” to “Suzhou QingYue Optoelectronics Technology Co., Ltd.”	2022-10-27	Page5 Page26 ALL

1 Application filed

Common Application

2 Overview

VGM256128A4W02 is a grayscale OLED display module with 256×128 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.

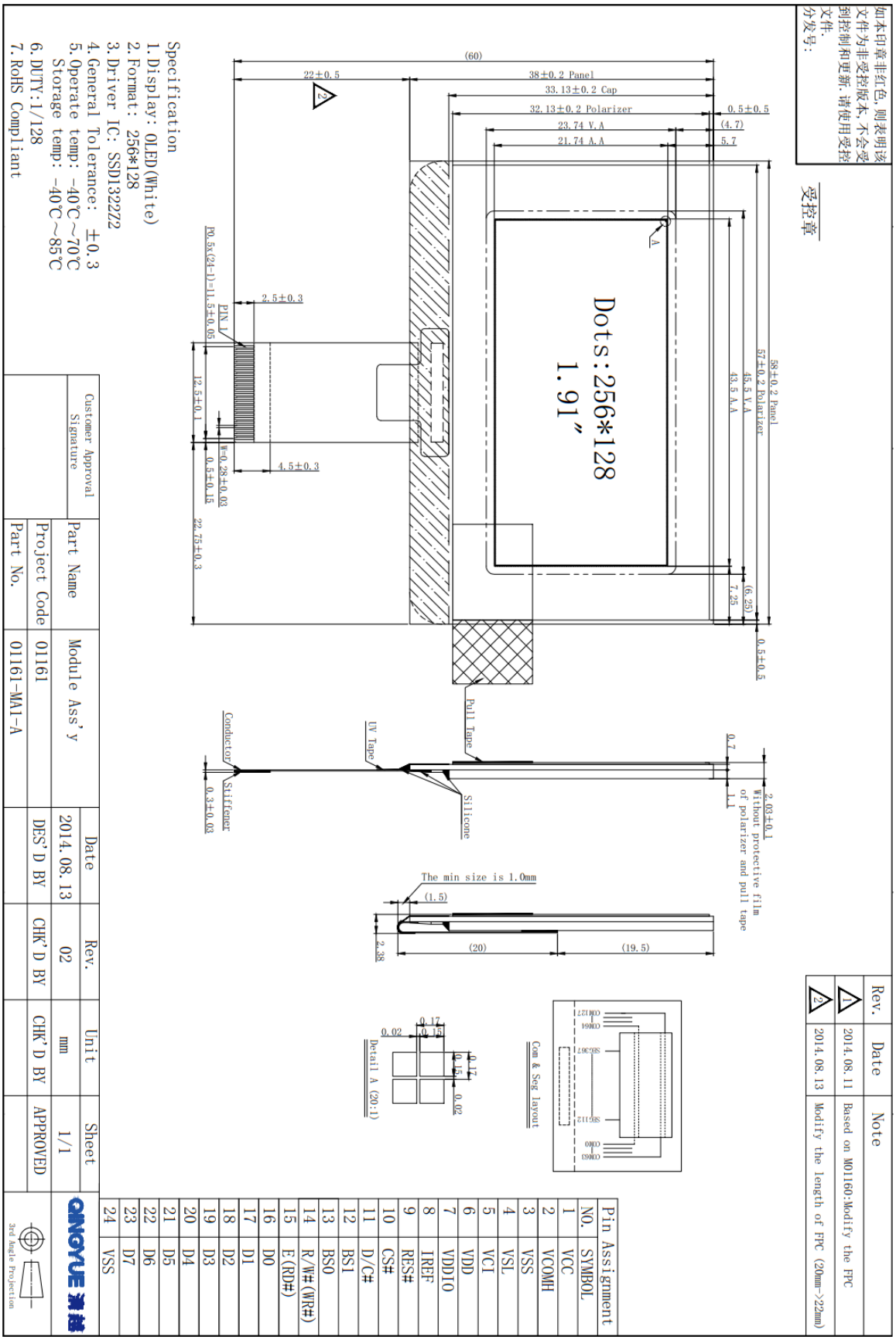
3 Features

- Display Color: White
- Dot Matrix: 256×128
- Driver IC: SSD1322Z2
- Interface: 8080,6800, 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	256(W)×128(H)	-
2	Dot Size	0.15(W)×0.15 (H)	mm^2
3	Dot Pitch	017(W)×0.17 (H)	mm^2
4	Aperture Rate	78	%
5	Active Area	43.5(W)×21.74(H)	mm^2
6	Panel Size	58(W)×38(H) ×1.8(T)	mm^3
7	Module Size	58(W)×60(H) ×2.03(T)	mm^3
8	Diagonal A/A Size	1.91	inch
9	Module Weight	8.41±10%	g

5 Mechanical Drawing

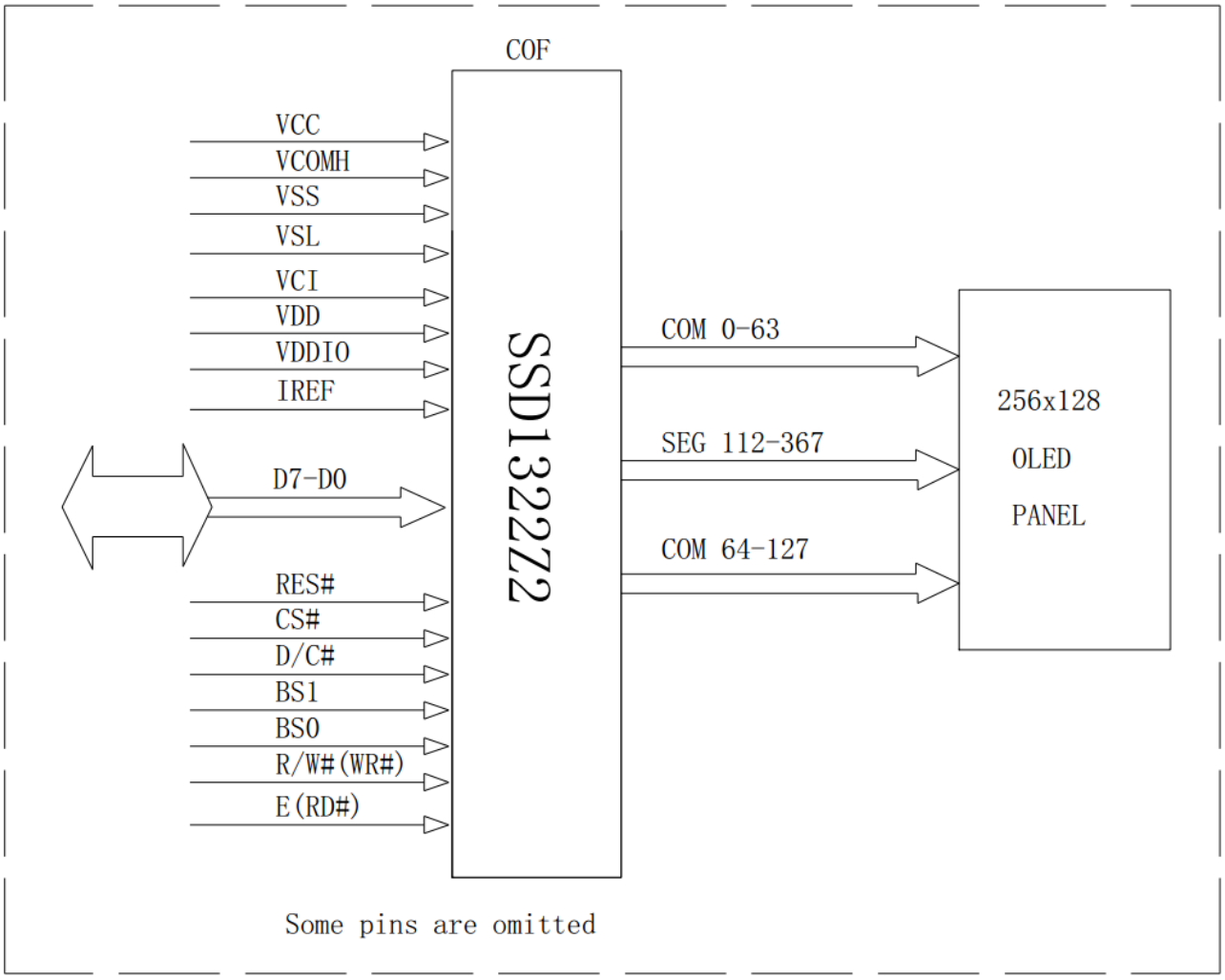


Pin Assignment		
NO.	SYMBOL	
1	VCC	
2	VCOMH	
3	VSS	
4	VSL	
5	VCI	
6	VDD	
7	VDDIO	
8	IREF	
9	RES#	
10	CS#	
11	D/C#	
12	BS1	
13	BS0	
14	R/W#(WR#)	
15	E(RD#)	
16	D0	
17	D1	
18	D2	
19	D3	
20	D4	
21	D5	
22	D6	
23	D7	
24	VSS	

6 Module Interface

<table>
<tr><th>PIN NO.</th><th>PIN NAME</th><th>DESCRIPTION</th></tr>
<tr><td>1</td><td>VCC</td><td>Power supply for panel driving voltage.</td></tr>
<tr><td>2</td><td>VCOMH</td><td>COM signal deselected voltage level.
A capacitor should be connected between this pin and VSS.</td></tr>
<tr><td>3</td><td>VSS</td><td>Ground pin.</td></tr>
<tr><td>4</td><td>VSL</td><td>This is segment voltage reference pin.
When external VSL is used, connect with resistor and diode to ground (details depend on application).</td></tr>
<tr><td>5</td><td>VCI</td><td>Low voltage power supply.
VCI must always be equal to or higher than VDD and VDDIO.</td></tr>
<tr><td>6</td><td>VDD</td><td>Power supply pin for core logic operation. A capacitor is required to connect between this pin and VSS.</td></tr>
<tr><td>7</td><td>VDDIO</td><td>Power supply for interface logic level. It should be matched with the MCU interface voltage level.</td></tr>
<tr><td>8</td><td>IREF</td><td>This pin is the segment output current reference pin.
A resistor should be connected between this pin and VSS to maintain the current around 10uA.</td></tr>
<tr><td>9</td><td>RES#</td><td>This pin is reset signal input.
When the pin is pulled LOW, initialization of the chip is executed.
Keep this pin pull HIGH during normal operation.</td></tr>
<tr><td>10</td><td>CS#</td><td>This pin is the chip select input connecting to the MCU. The chip is enabled for MCU communication only when CS# is pulled LOW.</td></tr>
<tr><td>11</td><td>D/C#</td><td>This pin is Data/Command control pin connecting to the MCU.
When the pin is pulled HIGH, the content at D[7:0] will be interpreted as data.
When the pin is pulled LOW, the content at D[7:0] will be interpreted as command.</td></tr>
<tr><td>12</td><td>BS1</td><td rowspan="2"><table><tr><th>Pin Name</th><th>8-bit 6800</th><th>8-bit 8080</th><th>4 Line SPI</th><th>3 Line SPI</th></tr><tr><td>BS0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr><tr><td>BS1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>13</td><td>BS0</td></tr>
<tr><td>14</td><td>R/W#(WR#)</td><td>This pin is read / write control input pin connecting to the MCU interface.
When interfacing to a 6800-series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Read mode will be carried out when this pin is pulled HIGH and write mode when LOW.
When 8080 interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled LOW and the chip is selected.
When serial interface is selected, this pin R/W (WR#) must be connected to VSS.</td></tr>
<tr><td>15</td><td>E(RD#)</td><td>This pin is MCU interface input.
When interfacing to a 6800-series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled HIGH and the chip is selected.
When connecting to an 8080-microprocessor, this pin receives the Read (RD#) signal. Read operation is initiated when this pin is pulled LOW and the chip is selected.
When serial interface is selected, this pin E(RD#) must be connected to VSS.</td></tr>
<tr><td>16~23</td><td>D0~D7</td><td>These pins are bi-directional data bus connecting to the MCU data bus.
Unused pins are recommended to tie LOW. (Except for D2 pin in SPI mode)</td></tr>
<tr><td>24</td><td>VSS</td><td>Ground pin.</td></tr>
</table>

7 Function Block Diagram



8 Absolute Maximum Ratings

ITEM	SYMBOL	MIN	MAX	UNIT	REMARK
Supply voltage	VDD	-0.5	2.75	V	IC maximum rating
	VCC	-0.5	21	V	IC maximum rating
	VDDIO	-0.5	VCI	V	IC maximum rating
	VCI	-0.3	4.0	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	2.4	-	2.6	V
Power Supply for I/O pins	VDDIO	22±3°C, 55±15%R.H	1.65	3.0	VCI	V
Low voltage power supply	VCI	22±3°C, 55±15%R.H	2.4	3.0	3.5	V
OLED Driver Supply Voltage	VCC	22±3°C, 55±15%R.H	12.7	13	13.3	V
High-level Input Voltage	V_{IH}	-	0.8×VDDIO	-	VDDIO	V
Low-level Input Voltage	V_{IL}	-	0	-	0.2×VDDIO	V
High-level Output Voltage	V_{OH}	-	0.9×VDDIO	-	VDDIO	V
Low-level Output Voltage	V_{OL}	-	0	-	0.1×VDDIO	V

Note : The VCC 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 (With Polarizer)	L_{br}	All pixels ON (1)		60	80	-	cd/m^2
VDD Sleep mode Current	I_{SLP_VDD}	VCI = VDDIO =2.8V, VCC =OFF VDD(external) = 2.5V, Display OFF, No panel attached		-	-	20	uA
VDDIO Sleep mode Current	I_{SLP_VDDIO}	VCI = VDDIO=2.8V, VCC =OFF Display OFF, No panel attached	External VDD=2.5V	-	-	20	uA
			Internal VDD	-	-	20	uA
VCI Sleep mode Current	I_{SLP_VCI}	VCI = VDDIO=2.8V, VCC =OFF Display OFF, No panel attached	External VDD=2.5V	-	-	20	uA
			Enable Internal VDD during Sleep mode	-	-	100	uA
			Disable Internal VDD during Sleep mode	-	-	20	uA
Normal Mode Power Consumption	Pt	All pixels ON(1)		-	383.5	460.2	mW
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: 0XA0
- Frame rate: 110Hz
- Duty setting: 1/128

9.3 AC Electrical Characteristics

(1) 6800-Series MPU Parallel Interface Timing Characteristics

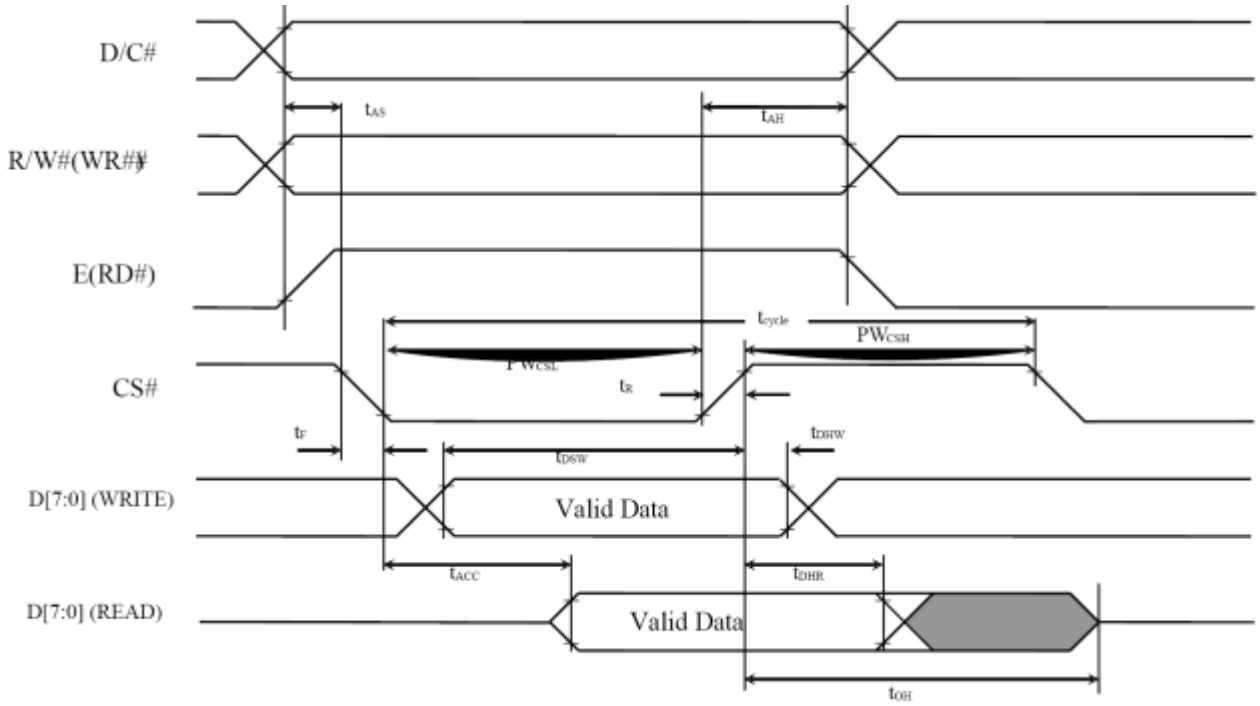
(VDDIO - VSS = 1.65V to 2.1V,VCI –VSS=2.4V to 3.5V, TA = 25℃)

Symbol	Parameter	Min	Typ	Max	Unit
t_{CYCLE}	Clock Cycle Time (read) Clock Cycle Time (write)	400 100	-	-	ns
t_{AS}	Address Setup Time	20	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	10	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	200	ns
PW_{CSL}	Chip Select Low Pulse Width (read) Chip Select Low Pulse Width (write)	450 60	-	-	ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

(VDDIO - VSS = 2.1V to VCI,VCI - VSS = 2.4V to 3.5V, TA = 25℃)

Symbol	Parameter	Min	Typ	Max	Unit
t_{CYCLE}	Clock Cycle Time (read) Clock Cycle Time (write)	300 100	-	-	ns
t_{AS}	Address Setup Time	15	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	10	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
PW_{CSL}	Chip Select Low Pulse Width (read) Chip Select Low Pulse Width (write)	150 60	-	-	ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

6800-series MCU parallel interface characteristics



(2) 8080-Series MPU Parallel Interface Timing Characteristics

(VDDIO - VSS = 1.65V to 2.1V,VCI - VSS = 2.4V to 3.5V, TA = 25 ℃)

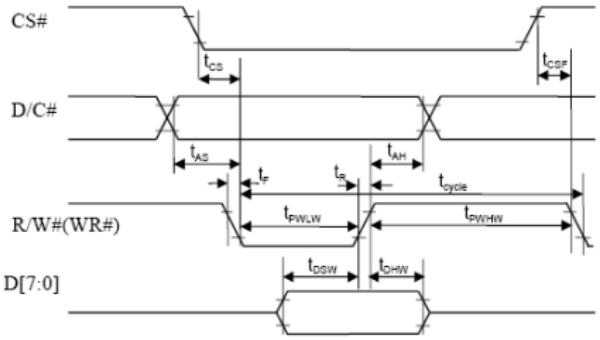
Symbol	Parameter	Min	Typ	Max	Unit
t_{CYCLE}	Clock Cycle Time (read) Clock Cycle Time (write)	400 100	-	-	ns
t_{AS}	Address Setup Time	10	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	10	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	220	ns
t_{PWLR}	Read Low Time	200	-	-	ns
t_{PWLW}	Write Low Time	60	-	-	ns
t_{PWHR}	Read High Time	60	-	-	ns
t_{PWHW}	Write High Time	60	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns
t_{CS}	Chip select setup time	0	-	-	ns
t_{CSH}	Chip select hold time to read signal	0	-	-	ns
t_{CSF}	Chip select hold time	20	-	-	ns

(VDDIO - VSS = 2.1V to VCI,VCI - VSS = 2.4V to 3.5V, TA = 25°C)

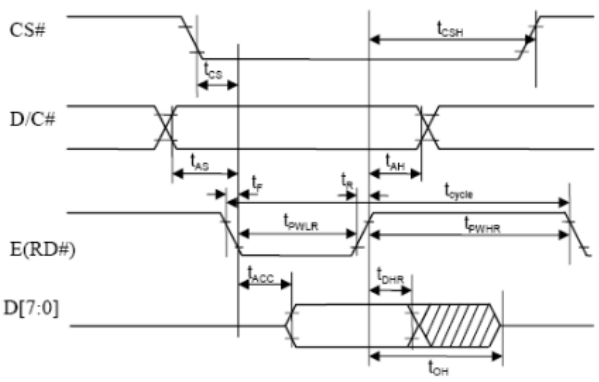
Symbol	Parameter	Min	Typ	Max	Unit
t_{CYCLE}	Clock Cycle Time (read) Clock Cycle Time (write)	300 100	-	-	ns
t_{AS}	Address Setup Time	10	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	10	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
t_{PWLR}	Read Low Time	150	-	-	ns
t_{PWLW}	Write Low Time	60	-	-	ns
t_{PWHR}	Read High Time	60	-	-	ns
t_{PWHW}	Write High Time	60	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns
t_{CS}	Chip select setup time	0	-	-	ns
t_{CSH}	Chip select hold time to read signal	0	-	-	ns
t_{CSF}	Chip select hold time	20	-	-	ns

8080-series MPU parallel interface characteristics

Write cycle



Read cycle



(3)Serial Interface Timing Characteristics (4-wire SPI)

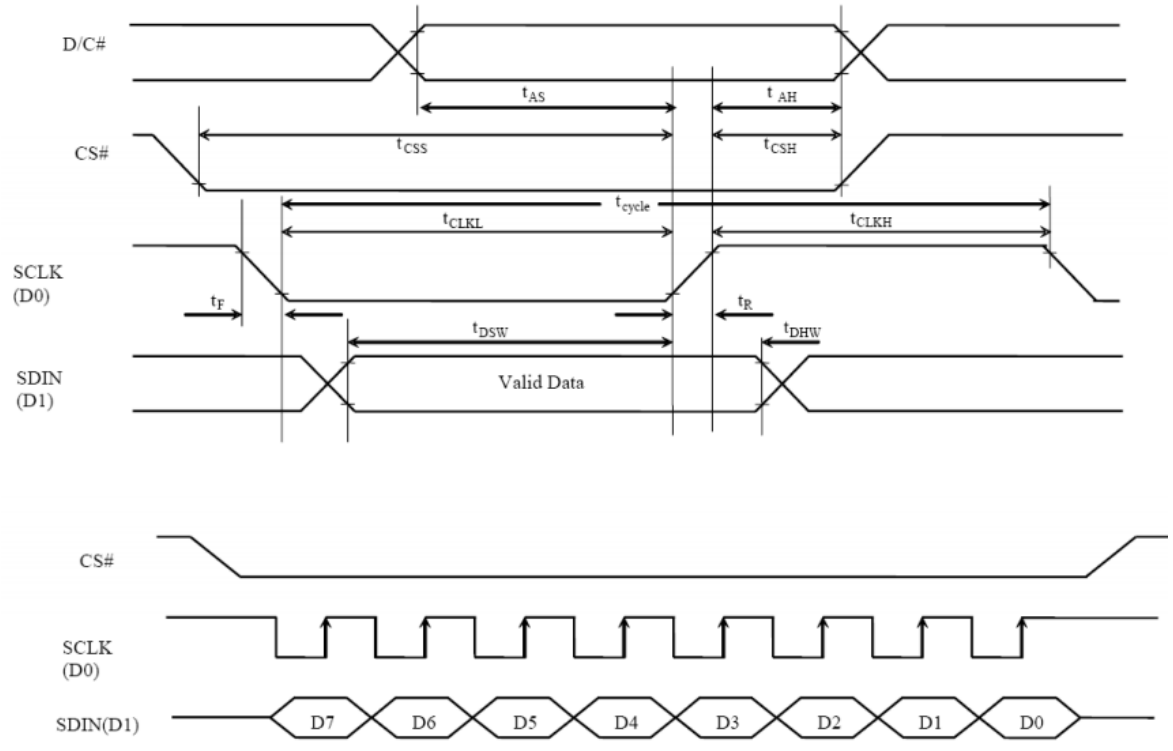
(VDDIO - VSS = 1.65V to 2.1V,VCI - VSS = 2.4V to 3.5V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	15	-	-	ns
t_{AH}	Address Hold Time	35	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	10	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	20	-	-	ns
t_{CLKL}	Clock Low Time	40	-	-	ns
t_{CLKH}	Clock High Time	40	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

(VDDIO - VSS = 2.1V to VCI,VCI - VSS = 2.4V to 3.5V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	15	-	-	ns
t_{AH}	Address Hold Time	25	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	10	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	20	-	-	ns
t_{CLKL}	Clock Low Time	25	-	-	ns
t_{CLKH}	Clock High Time	40	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

Serial interface characteristics (4-wire SPI)



(4)Serial Interface Timing Characteristics (3-wire SPI)

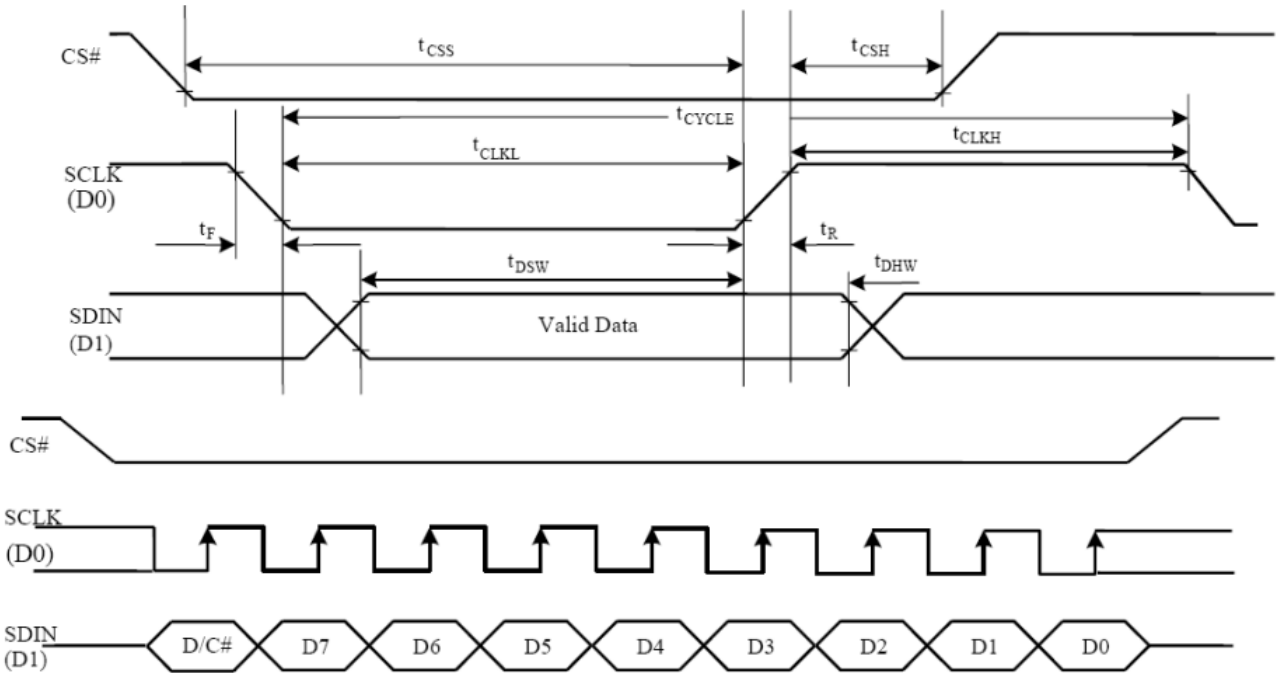
(VDDIO - VSS = 1.65V to 2.1V,VCI - VSS = 2.4V to 3.5V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	35	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	20	-	-	ns
t_{CLKL}	Clock Low Time	40	-	-	ns
t_{CLKH}	Clock High Time	25	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

(VDDIO - VSS = 2.1V to VCI,VCI - VSS = 2.4V to 3.5V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	25	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	20	-	-	ns
t_{CLKL}	Clock Low Time	25	-	-	ns
t_{CLKH}	Clock High Time	25	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns

Serial interface characteristics (3-wire SPI)

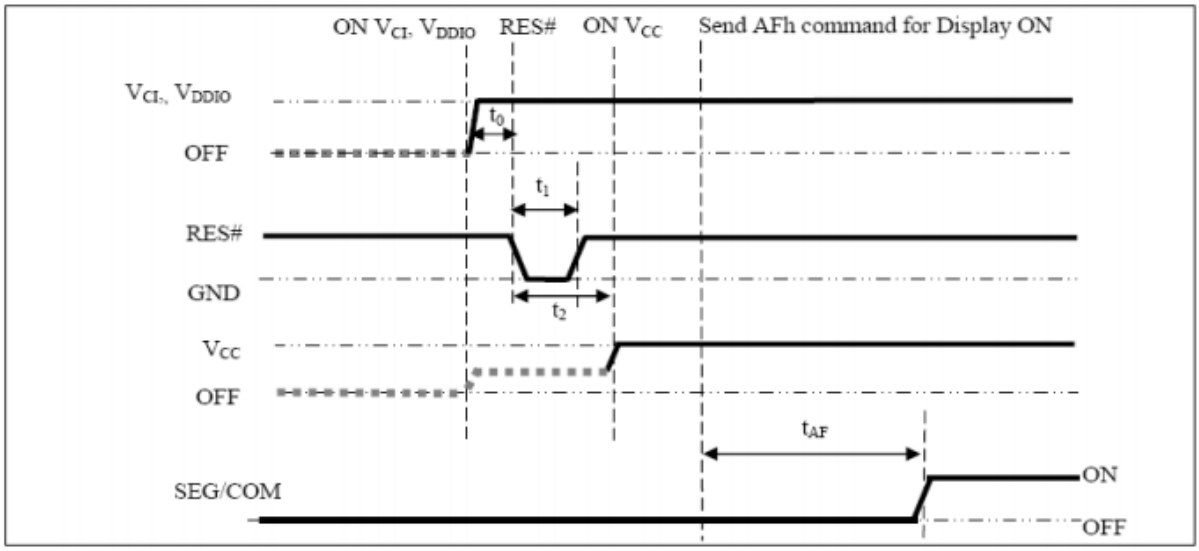


10 Functional Specification and Application Circuit

10.1 Power ON and Power OFF Sequence

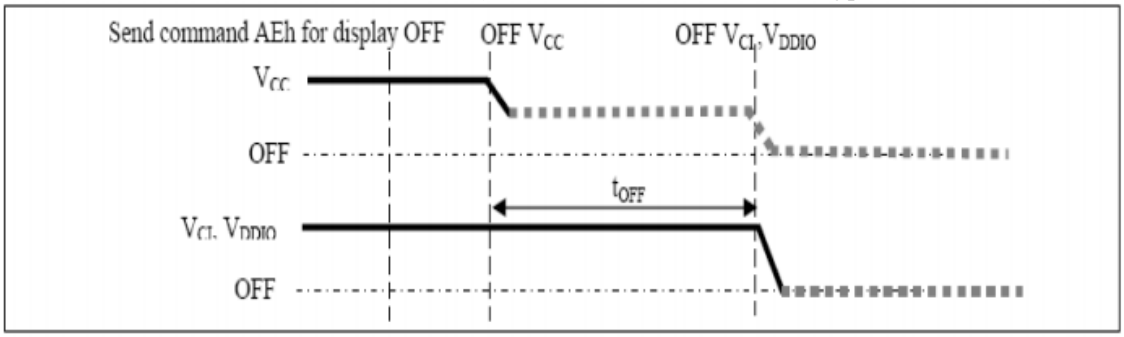
Power on sequence：

1. Power ON VCI, VDDIO.
2. After VCI, VDDIO become stable, set wait time at least 1ms (t0) for internal VDD become stable. Then set RES# pin LOW (logic low) for at least 100us (t1) (4)and then HIGH (logic high).
3. After set RES# pin LOW (logic low), wait for at least 100us (t2). Then Power ON VCC.(1)
4. After VCC become stable, send command AFh for display ON. SEG/COM will be ON after 200ms(tAF).
5. After VCI become stable, wait for at least 300ms to send command.



Power on sequence：

1. Send command AEh for display OFF.
2. Power OFF VCC.(1), (2)
3. Wait for t_{OFF}. Power OFF VCI , VDDIO. (where Minimum t_{OFF}=0ms(3), Typical t_{OFF} =100ms)



Power off sequence：

(1) Since an ESD protection circuit is connected between VCI, VDDIO and VCC, VCC becomes lower than VCI whenever VCI,VDDIO is ON and VCC is OFF as shown in the dotted line of VCC in above Figure.
(2)VCC should be kept float (disable) when it is OFF.
(3) VCI, VDDIO should not be Power OFF before VCC Power OFF.
(4) The register values are reset after t1.
(5) Power pins (VDD, VCC) can never be pulled to ground under any circumstance.

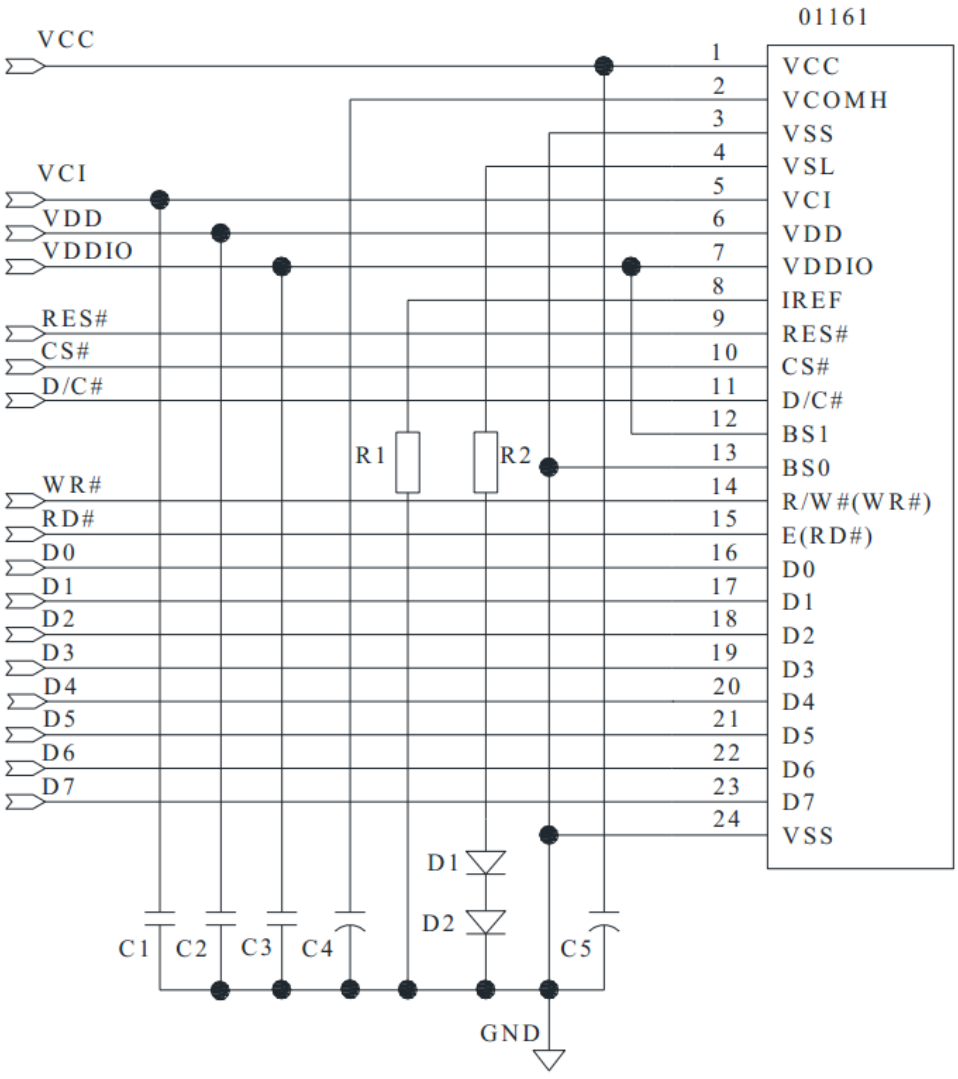
10.2 Application Circuit

The double byte command for 0xAB is used to enable or disable the VDD regulator.

No matter VDD is supplied by external source or internal regulated ; VCI must always be set equivalent to or higher than VDD and VDDIO.

(A) VDD can be supplied externally (with the range of 2.4V to 2.6V,VCI must always be set equivalent to or higher than VDD and VDDIO.) when A[0] is set to 0b.

（1）The configuration for 4-wire SPI interface mode, external VCC is shown in the following diagram:



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

Recommended components

C4,C5: 4.7μF/25V.RoHS (Tantalum Capacitors)

C1,C2,C3: 0.1uF-0603-X7R±10%.RoHS

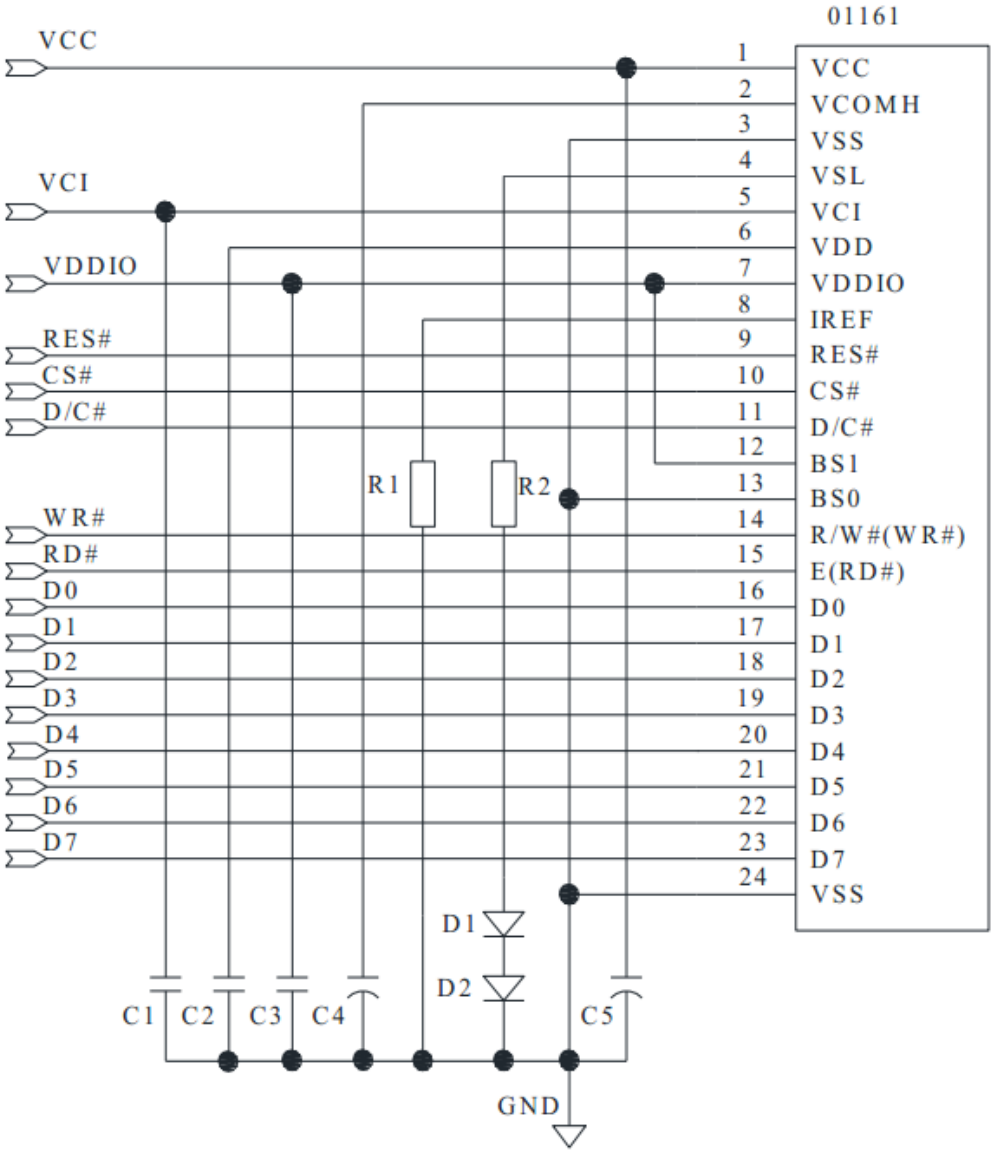
R1: 0603 1/10W +/-5% 910KΩ.RoHS

R2: 0603 1/10W +/-5% 51Ω.RoHS

D1,D2: 1N4148

(B) VDD can be supplied regulated internally from VCI(VCI must be > 2.6V), when A[0] is set to 1b.

(1).The configuration for 8080-parallel interface mode, external VCC is shown in the following diagram:



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

Recommended components

C4,C5: 4.7μF/25V.RoHS (Tantalum Capacitors)

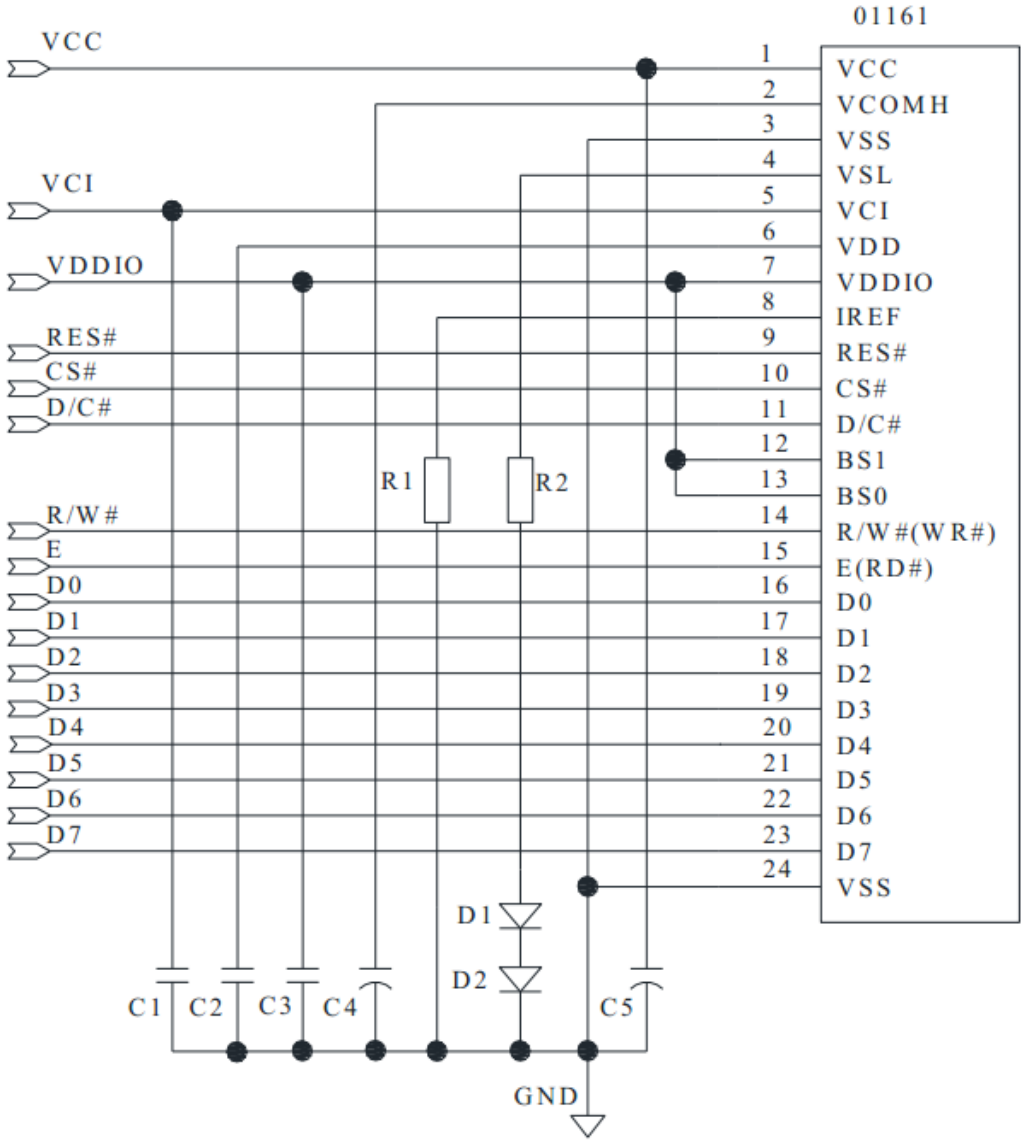
C1,C2,C3: 0.1uF-0603-X7R±10%.RoHS

R1: 0603 1/10W +/-5% 910KΩ.RoHS

R2: 0603 1/10W +/-5% 51Ω.RoHS

D1,D2: 1N4148

(2) The configuration for 6800-parallel interface mode, external VCC is shown in the following diagram:



Pin connected to MCU interface: D[7:0], E, R/W#, D/C#, CS#, RES#

Recommended components

C4,C5: 4.7μF/25V.RoHS (Tantalum Capacitors)

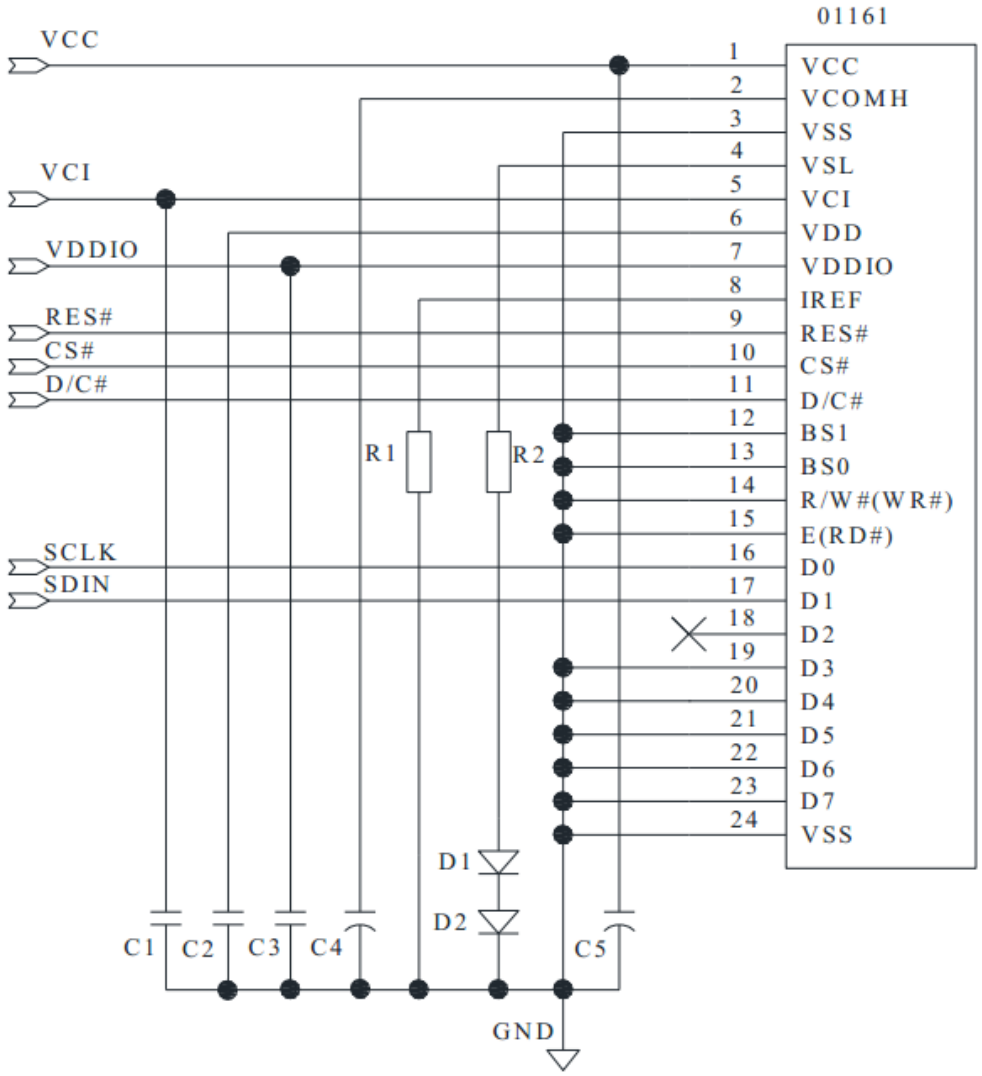
C1, C2, C3: 0.1uF-0603-X7R±10%.RoHS

R1: 0603 1/10W +/-5% 910KΩ.RoHS

R2: 0603 1/10W +/-5% 51Ω.RoHS

D1,D2: 1N4148

(3) The configuration for 4-SPI interface mode, external VCC is shown in the following diagram:



Pin connected to MCU interface: SCLK,SDIN, D/C#, CS#, RES#

Recommended components

C4,C5: 4.7μF/25V.RoHS (Tantalum Capacitors)

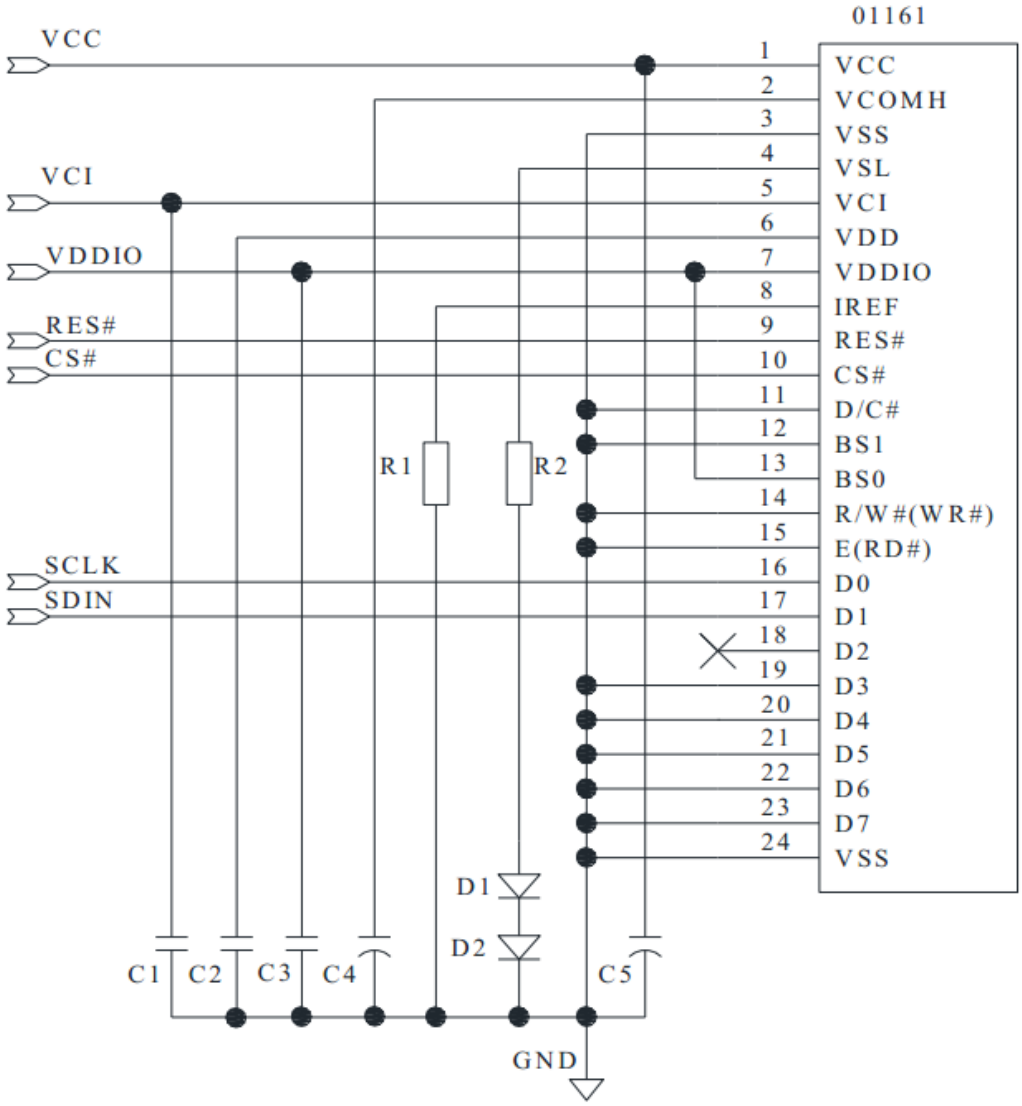
C1, C2, C3: 0.1uF-0603-X7R±10%.RoHS

R1: 0603 1/10W +/-5% 910KΩ.RoHS

R2: 0603 1/10W +/-5% 51Ω.RoHS

D1,D2: 1N4148

(4) The configuration for 3-wire SPI interface mode, external VCC is shown in the following diagram:



Pin connected to MCU interface: SCLK,SDIN, CS#, RES#

Recommended components

C4,C5: 4.7μF/25V.RoHS (Tantalum Capacitors)

C1, C2, C3: 0.1uF-0603-X7R±10%.RoHS

R1: 0603 1/10W +/-5% 910KΩ.RoHS

R2: 0603 1/10W +/-5% 51Ω.RoHS

D1,D2: 1N4148

10.3 Display Control Instruction

Refer to SSD1322Z2 IC Specification.

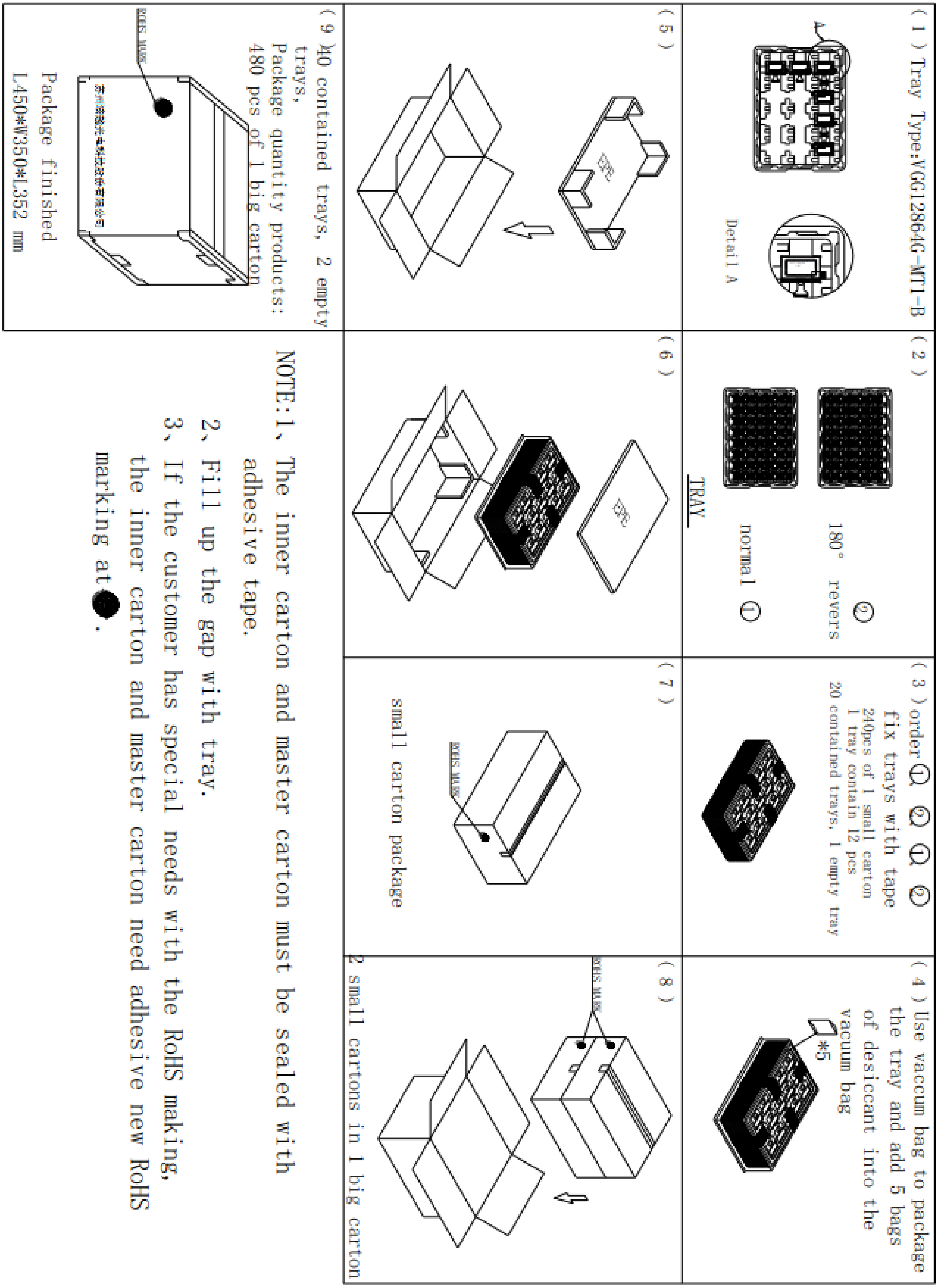
10.4 Recommended Software Initialization

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(0xFD);        //Lock OLED driver IC MCU interface from entering command
   Write_Data(0x12);
   Write_Command(0xAE);        //Set Display Off
   Write_Command(0x15);         //Set Column start and end address
   Write_Data(0x1C);
   Write_Data(0x5B);
   Write_Command(0x75);         //Set Row start and end address
   Write_Data(0x00);
   Write_Data(0x7F);
   Write_Command(0xA0);
   Write_Data(0x24);
   Write_Data(0x01);
   Write_Command(0xA1);        //Set Display Start Line
   Write_Data(0x00);
   Write_Command(0xA2);        //Set Display Offset
   Write_Data(0x00);
   Write_Command(0xAB);         //Function Selection
   Write_Data(0x01);            //Enable internal VDD regulator
   Write_Command(0xB1);        //Set Phase length
   Write_Data(0xF1);
   Write_Command(0xB3);        //Set Front Clock Divider/Oscillator Frequency
   Write_Data(0x50);            //110Hz
   Write_Command(0xB4);        //Display Enhancement A
   Write_Data(0xA0);           //Enable external VSL
   Write_Data(0xB5);            //Normal    FD
   Write_Command(0xB5);       //GPIO
   Write_Data(0x00);
   Write_Command(0xB6);       //Set Phase length
   Write_Data(0x08);
```

```
    Write_Command(0xB9);        //Select Default Linear Gray Scale table
    Write_Command(0xBB);        //Set Pre-charge voltage
    Write_Data(0x1F);
    Write_Command(0xBE);        //Set Vcomh
    Write_Data(0x00);
    Write_Command(0xC1);        //Set_Contrast
    Write_Data(0xA0);
    Write_Command(0xC7);        //Master_Contrast
    Write_Data(0x0F);
    Write_Command(0xCA);        //Set MUX Ratio
    Write_Data(0x7F);
    Write_Command(0xD1);        //Display_En_B
    Write_Data(0xA2);
    Write_Data(0x20);
    Write_Command(0xA6);        //Normal Display
     Clear_Screen();
    Write_Command(0xAF);        //Set Display On
}
```

11 Package Specification



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

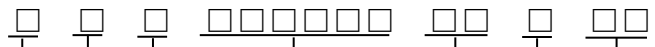
End of lifetime is specified as 50% of initial brightness and the test pattern at operating condition is 50% alternating checkerboard.

ITEM	MIN	MAX	UNIT	CONDITION
Operation Life Time	20,000	-	h	80 cd/m², 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

M—amber

W—white

A—area color

F—full color

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

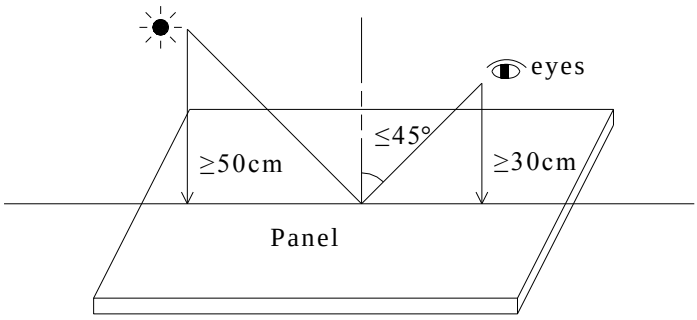
Fluorescent Lamp: 30W

Distance between the Panel & Lamp: ≥50cm

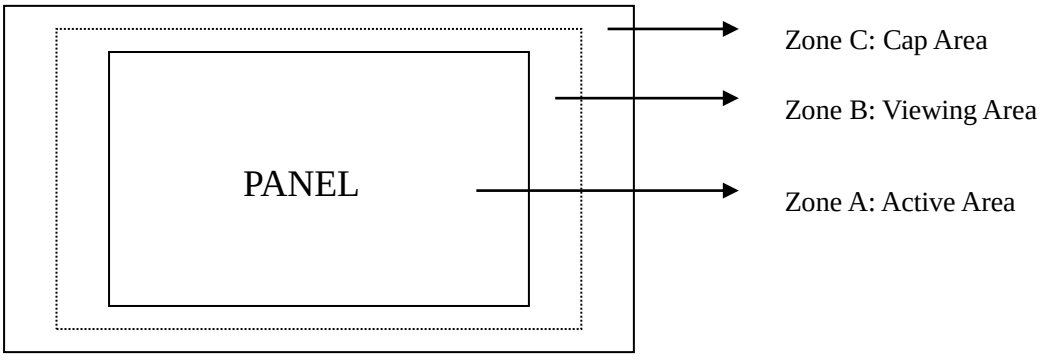
Distance between the Panel & Eyes: ≥30cm

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

(See the sketch below)

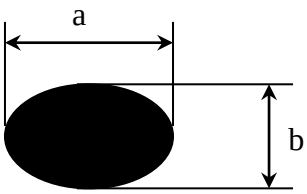


14.3 Quality Assurance Zones

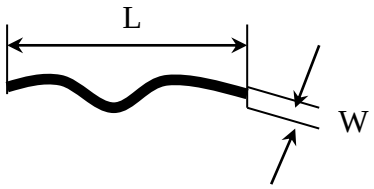


14.4 Inspection Standard

Definition of Φ&L&W (Unit: mm)

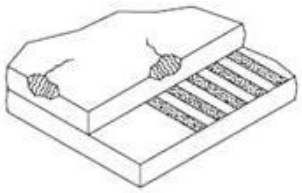
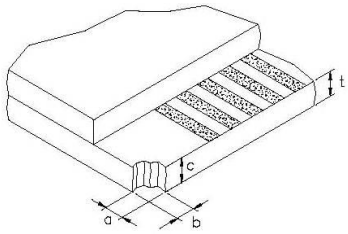
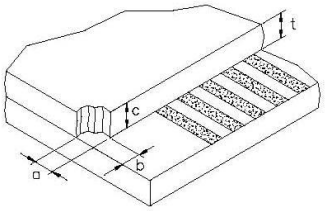
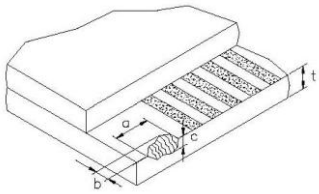
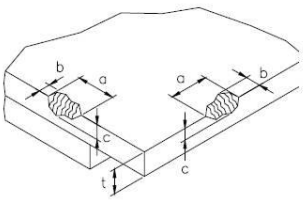
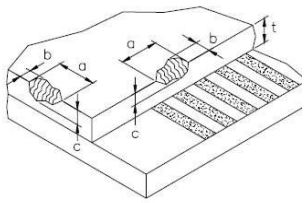


Φ=(a+b)/2



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 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	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 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.