DisplayModule

DM-OLED13-637

1.3” 128 X 64 MONOCHROME GRAPHIC OLED DISPLAY MODULE - I2C

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1 Revision History

Date	Changes
2018-09-13	First release

2 Main Features

Item	Specification	Unit
Diagonal Size	1.3”	inch
Display Mode	Passive Matrix OLED	-
Display Colors	Monochrome	Colors
Resolution	128 x 64	pixel
Controller IC	SH1106	-
Duty	1/64	duty
Interface	I2C	-
Active Area	29.42 x 14.7	mm
Module Dimension	35.4 x 33.5 x 2.7	mm
Weight	TBD	g

3 Pin Description

3.1 Panel Pin Description

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Function Description</th></tr>
<tr><td>1</td><td>NC(GND)</td><td>Reserved Pin (Supporting Pin)
The supporting pins can reduce the influences from stresses on the function pins.
These pins must be connected to external ground as the ESD protection circuit.</td></tr>
<tr><td>2-3
4-5</td><td>C2P/C2N
C1P/C1N</td><td>Negative Terminal of the Flying Boost Capacitor
Positive Terminal of the Flying Inverting Capacitor
The charge-pump capacitors are required between the terminals. They must be floated when the converter is not used.</td></tr>
<tr><td>6</td><td>VBAT</td><td>Power Supply for DC/DC Converter Circuit
This is the power supply pin for the internal buffer of the DC/DC voltage converter.
It must be connected to external source when the converter is used. It should be connected to VDD when the converter is not used.</td></tr>
<tr><td>7</td><td>NC</td><td>Reserved Pin
The N.C. pin between function pins are reserved for compatible and flexible design.</td></tr>
<tr><td>8</td><td>VSS</td><td>Ground of Logic Circuit
This is a ground pin. It acts as a reference for the logic pins. It must be connected to external ground.</td></tr>
<tr><td>9</td><td>VDD</td><td>Power Supply for Logic
This is a voltage supply pin. It must be connected to external source.</td></tr>
<tr><td>10
11
12</td><td>BS0
BS1
BS2</td><td>Communicating Protocol Select
These pins are MCU interface selection input. See the following table:
<table>
<tr><th></th><th>BS0</th><th>BS1</th><th>BS2</th></tr>
<tr><td>I2C</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>3-wire SPI</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>4-wire SPI</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>8-bit 68xx parallel</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>8-bit 80xx parallel</td><td>0</td><td>1</td><td>1</td></tr>
</table></td></tr>
<tr><td>13</td><td>CS#</td><td>Chip Select
This pin is the chip select input. The chip is enabled for MCU communication only when CS# is pulled low.</td></tr>
<tr><td>14</td><td>RES#</td><td>Power Reset for Controller and Driver
This pin is reset signal input. When the pin is low, initialization of the chip is executed. Keep this pin pull high during normal operation.</td></tr>
<tr><td>15</td><td>D/C#</td><td>Data/Command Control
This pin is Data/Command control pin. When the pin is pulled high, the input at D7~D0 is treated as display data. When the pin is pulled low, the input at D7~D0 will be transferred to the command register.
When the pin is pulled high and serial interface mode is selected, the data</td></tr>
</table>

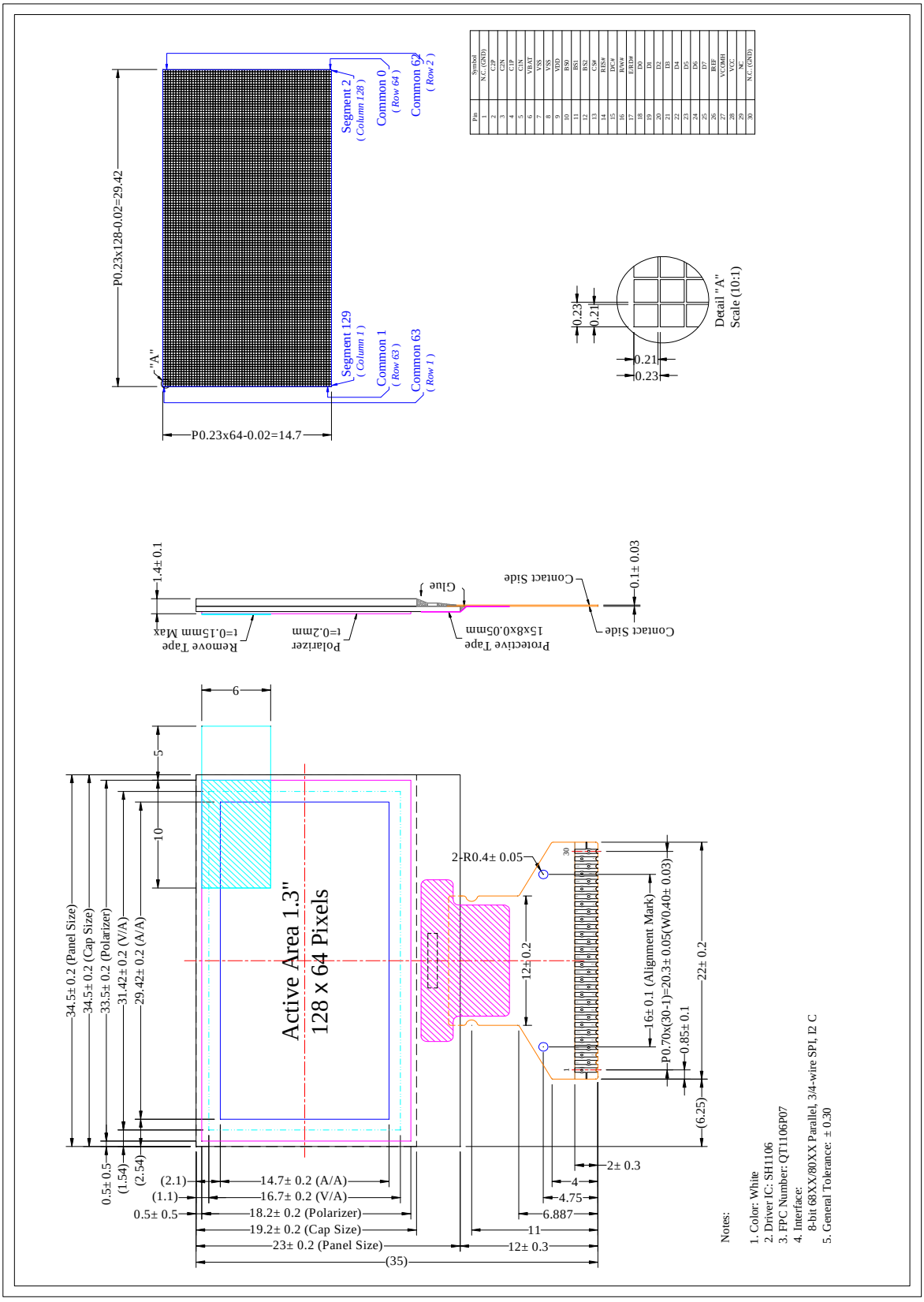
		at SDIN will be interpreted as data. When it is pulled low, the data at SDIN will be transferred to the command register. In I2C mode, this pin acts as SA0 for slave address selection. For detail relationship to MCU interface signals, please refer to the Timing Characteristics Diagrams.
16	R/W#	Read/Write Select or Write This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Pull this pin to "High" for read mode and pull it to "Low" for write mode. When 80XX 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 CS# is pulled low. When serial or I2C mode is selected, this pin must be connected to VSS
17	E/RD#	Read/Write Enable or Read This pin is MCU interface input. When interfacing to a 68XX-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 CS# is pulled low. When connecting to an 80XX-microprocessor, this pin receives the Read (RD#) signal. Data read operation is initiated when this pin is pulled low and CS# is pulled low. When serial or I2C mode is selected, this pin must be connected to VSS.
18-25	D0~D7	Host Data Input/ Output Bus These pins are 8-bit bi-directional data bus to be connected to the microprocessor's data bus. When serial mode is selected, D1 will be the serial data input SDIN and D0 will be the serial clock input SCLK. When I2C mode is selected, D2 & D1 should be tired together and serve as SDAout & SDAin in application and D0 is the serial clock input SCL. Unused pins must be connected to VSS except for D2 in serial mode.
26	IREF	Current Reference for Brightness Adjustment This pin is segment current reference pin. A resistor should be connected between this pin and VSS. Set the current at 12.5μA maximum.
27	VCOMH	Voltage Output High Level for COM Signal This pin is the input pin for the voltage output high level for COM signals. A capacitor should be connected between this pin and VSS.
28	VCC	Power Supply for OEL Panel This is the most positive voltage supply pin of the chip. A stabilization capacitor should be connected between this pin and VSS when the converter is used. It must be connected to external source when the converter is not used.
29	VLSS	Ground of Analog Circuit This is an analog ground pin. It should be connected to VSS externally.
30	NC(GND)	Reserved Pin (Supporting Pin) The supporting pins can reduce the influences from stresses on the function pins. These pins must be connected to external ground as the ESD protection circuit.

3.2 Module Pin Description

Pin No.	Symbol	Function Description
1	GND	Ground
2	VCC_IN	Power Supply (2.8~5.5V)
3	SCL	IIC Clock
4	SDA	IIC Date

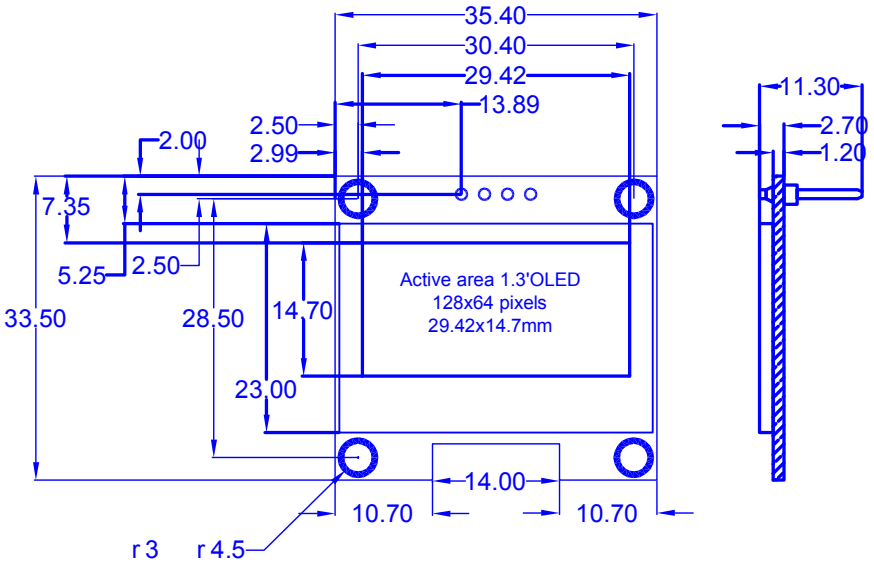
4 Mechanical Drawing

4.1 Panel Mechanical Drawing



Pin	Symbol
1	N.C. (GND)
2	C2P
3	C2N
4	C1P
5	C1N
6	VBAT
7	VSS
8	VSS
9	VDD
10	BS0
11	BS1
12	BS2
13	CS#
14	RES#
15	D/C#
16	R/W#
17	E/RD#
18	D0
19	D1
20	D2
21	D3
22	D4
23	D5
24	D6
25	D7
26	IREF
27	VCOMH
28	VCC
29	NC
30	N.C. (GND)

4.2 Module Mechanical Drawing



5 Electrical Characteristics

Item	Symbol	Condition	Min	Typ.	Max	Unit
Supply Voltage for Logic	VDD		1.65	2.8	3.3	V
Supply Voltage for Display (Supplied Externally)	VCC	Internal DC/DC Disable	-	12	-	V
Supply Voltage for DC/DC	VBAT	Internal DC/DC Enable	3.5	-	4.2	V
Supply Voltage for Display (Generated by Internal DC/DC)	VCC	Internal DC/DC Enable	6.4	-	9	V
Operating Current	Ibat	Note 1	-	45	50	mA
Low Level Input Voltage	V_{IL}		0	-	$0.2xV_{DD}$	V
High Level Input Voltage	V_{IH}		$0.8xV_{DD}$	-	V_{DD}	V
Low Level Output Voltage	V_{OL}		0		$0.1xV_{DD}$	V
High Level Output Voltage	V_{OH}		$0.9xV_{DD}$		V_{DD}	V
Operating Temperature	TOP	Absolute Max	-40		85	℃
Storage Temperature	TST	Absolute Max	-40		85	℃

Note 1: VDD = 2.8V, VCC = 8V, IREF=560K 100% Display Area Turn on.

6 Optical Characteristics

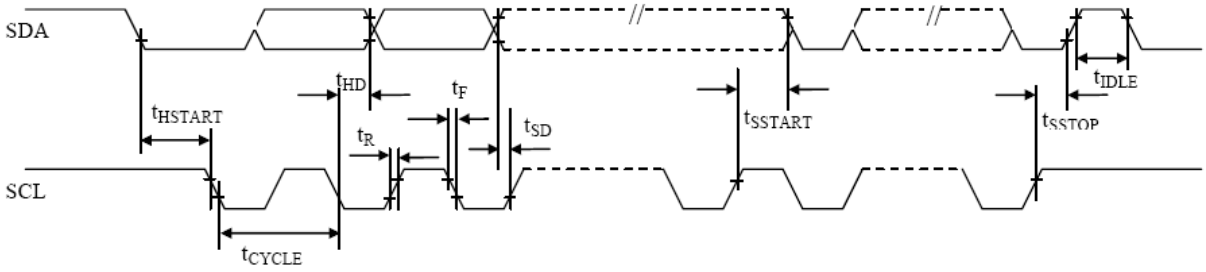
Item	Symbol	Min	Typ	Max	Unit
View Angles			Free		°
Response Time (25℃)	Tr + Tf				us
Brightness (Vcc generated by internal DC/DC)		100	150	-	cd/m ²
Contrast Ratio	CR		2,000:1		
Lifetime		10,000			Hrs

7 Timing Characteristics

7.1 I2C Interface Timing Characteristics

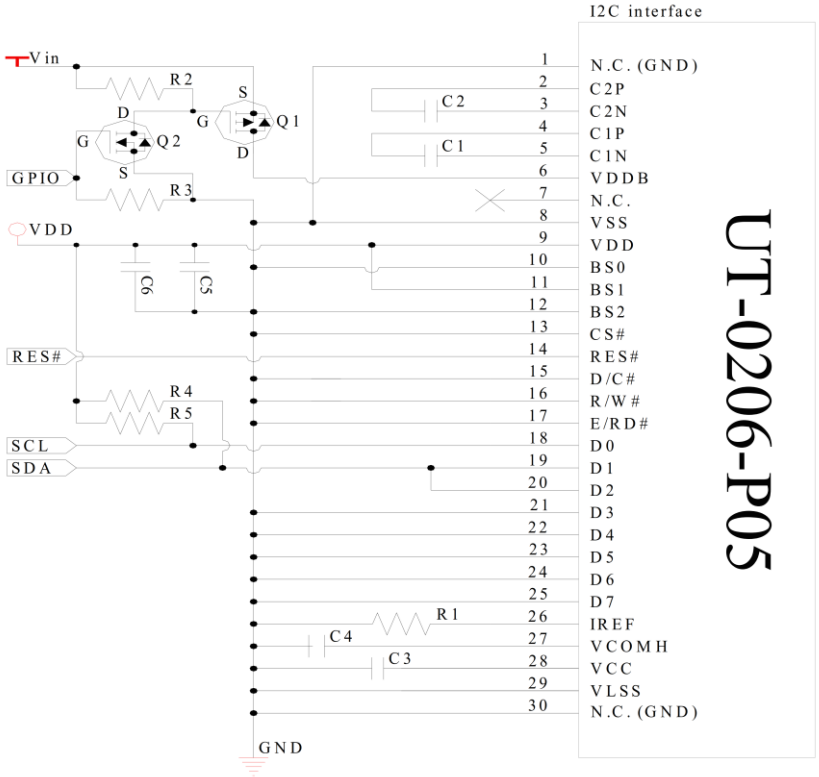
TA=25℃,VDD-VSS=1.65-3.5V

Symbol	Item	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	2.5	-	-	µs
t_{HSTART}	Start Condition Hold Time	0.6	-	-	µs
t_{HD}	Data Hold Time (for "SDA_{OUT}" Pin)	0	-	-	ns
	Data Hold Time (for "SDA_{IN}" Pin)	300	-	-	ns
t_{SD}	Data Setup Time	100	-	-	ns
t_{SSTART}	Start Condition Setup Time (Only relevant for a repeated Start Condition)	0.6	-	-	µs
t_{SSTOP}	Stop Condition Setup Time	0.6	-	-	µs
t_R	Rise Time for Data and Clock Pin	-	-	300	ns
t_F	Fall Time for Data and Clock Pin	-	-	300	ns
t_{IDLE}	Idle Time before a New Transmission can Start	1.3	-	-	µs



7.2 I2C Interface With Internal Charge Pump

When design main board, Please add Electronic Switch circuit, otherwise, will be caused leak current



Recommended Components:

C1, C2: 1 μ F / 16V, X5R

C3: 2.2 μ F

C4: 4.7 μ F / 16V, X7R

C5, C6: 1 μ F

R1: 560kΩ, R1 = (Voltage at IREF - VSS) / IREF

R2, R3: 47kΩ

R4, R5: 4.7kΩ

Q1: FDN338P

Q2: FDN335N

Notes:

VDD: 1.65~3.3V, it should be equal to MPU I/O voltage.

Vin: 3.5~4.2V

The I2C slave address is 0111100b’. If the customer ties D/C# (pin 15) to VDD, the I2C slave address will be 0111101b’.

* VBAT will be connected to VDD when VCC be connected to external source (12V), R1 should be replaced as 910 kΩ.

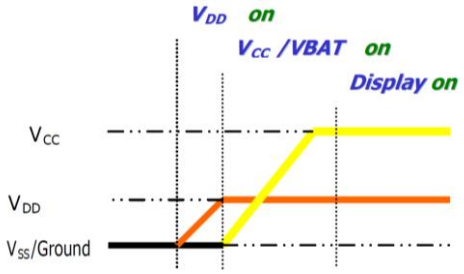
8 Functional Specification

8.1 Power down and Power up Sequence

To protect OEL panel and extend the panel life time, the driver IC power up/down routine should include a delay period between high voltage and low voltage power sources during turn on/off. It gives the OEL panel enough time to complete the action of charge and discharge before/after the operation.

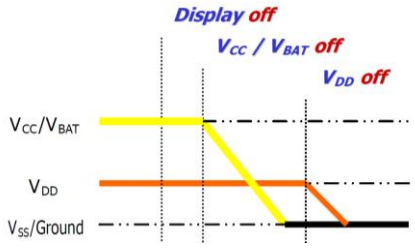
Power up Sequence

1. Power up V_{DD}/V_{BAT}
2. Send Display off command
3. Initialization
4. Clear Screen
5. Power up V_{CC}
6. Delay 100ms(When V_{CC} is stable)
7. Send Display on command



Power down Sequence

1. Send Display off command
2. Power down V_{CC}/V_{BAT}
3. Delay 100ms
   (When V_{CC}/V_{BAT} is reach 0 and panel is completely discharges)
4. Power down V_{DD}

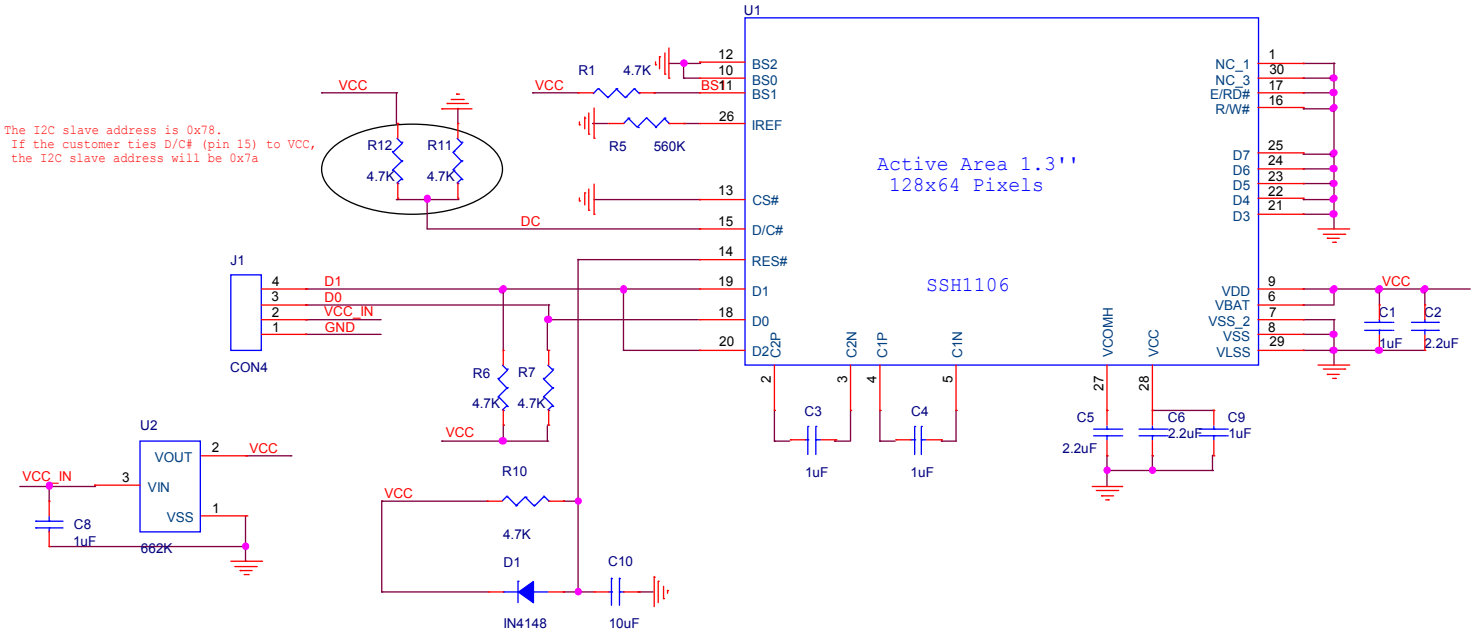


8.2 Reset Circuit

When RES# input is low, the chip is initialized with the following status:

1. Display is OFF
2. 128x64 Display Mode
3. Normal segment and display data column and row address mapping (SEG0 mapped to column address 00h and COM0 mapped to row address 00h)
4. Shift register data clear in serial interface
5. Display start line is set at display RAM address 0
6. Column address counter is set at 0
7. Normal scan direction of the COM outputs
8. Contrast control register is set at 7Fh
9. Normal display mode (Equivalent to A4h command)

9 Module Schematic



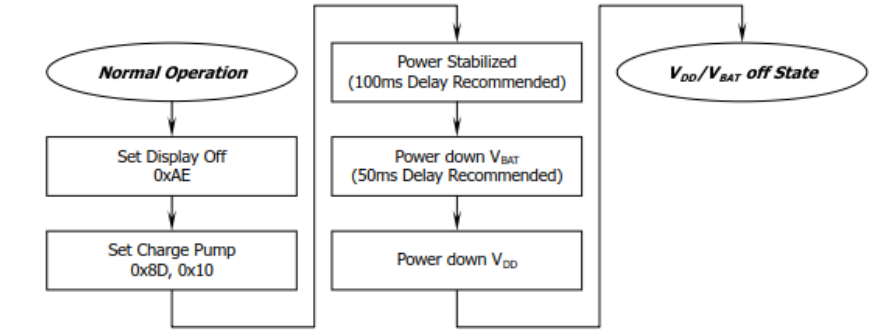
10 Example Application

VCC Generated by Internal DC/DC Circuit

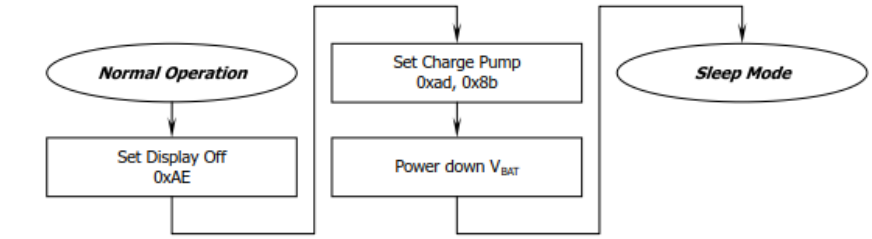
<Power up Sequence>

If the noise is accidentally occurred at the displaying window during the operation, please reset the display in order to recover the display function.

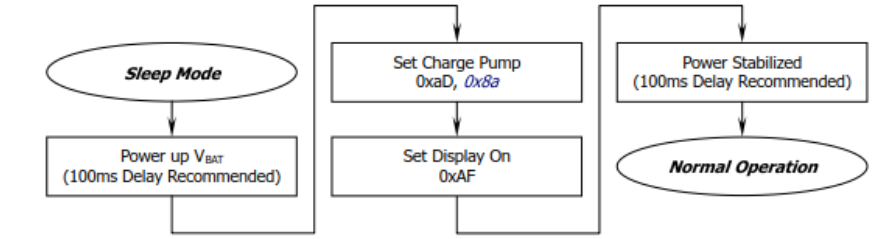
<Power down Sequence>



<Entering Sleep Mode>



<Exiting Sleep Mode>



Internal setting（Charge pump）

```
{
RES=1;
 delay(1000);
 RES=0;
 delay(1000);
 RES=1;
 delay(1000);
write_i(0xAE); /*display off*/

 write_i(0x02); /*set lower column address*/
 write_i(0x10); /*set higher column address*/

write_i(0x40); /*set display start line*/

 write_i(0xB0); /*set page address*/

 write_i(0x81); /*contract control*/
```

```
 write_i(0xff); /*128*/

 write_i(0xA1); /*set segment remap*/

 write_i(0xA6); /*normal / reverse*/

 write_i(0xA8); /*multiplex ratio*/
 write_i(0x3F); /*duty = 1/64*/

 write_i(0xad); /*set charge pump enable*/
 write_i(0x8b); /* 0x8B 内供 VCC */

 write_i(0x33); /*0X30---0X33 set VPP 9V */

 write_i(0xC8); /*Com scan direction*/

 write_i(0xD3); /*set display offset*/
 write_i(0x00); /* 0x20 */

 write_i(0xD5); /*set osc division*/
 write_i(0x80);

 write_i(0xD9); /*set pre-charge period*/
 write_i(0x1f); /*0x22*/

 write_i(0xDA); /*set COM pins*/
 write_i(0x12);

 write_i(0xdb); /*set vcomh*/
 write_i(0x40);

 write_i(0xAF); /*display ON*/
 }



void write_i(unsigned char ins)
{

 DC=0;
 CS=0;
 WR=1;
 P1=ins; /*inst*/
 WR=0;
WR=1;
 CS=1;
}
```

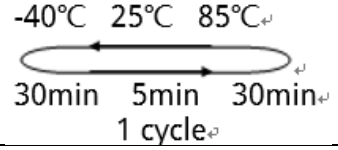
```
void write_d(unsigned char dat)
{
 DC=1;
 CS=0;
 WR=1;
 P1=dat; /*data*/
 WR=0;
 WR=1;
 CS=1;
}


void delay(unsigned int i)
{
 while(i>0)
 {
 i--;
 }
}
```

11 Command Table

Please check Driver IC datasheet

12 Reliability

Test Item	Content of Test	Test Condition	Note
High Temperature Storage	Endurance test applying the high storage temperature for a long time.	85℃ 200hrs	2
Low Temperature Storage	Endurance test applying the high storage temperature for a long time.	-40℃ 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	85℃ 200hrs	-
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-40 ℃ 200hrs	1
High Temperature/ Humidity Operation	The module should be allowed to stand at 60℃,90%RH max, for 96hrs under no-load condition excluding the polarizer. Then taking it out and drying it at normal temperature.	60℃,90%RH 96hrs	1,2
Thermal Shock Resistance	The sample should be allowed stand the following 10 cycles of operation 	-40℃/85℃ 10 cycles	-
Vibration Test	Endurance test applying the vibration during transportation and using	Total fixed amplitude: 15mm; Vibration: 10~55Hz; One cycle 60 seconds to 3 directions of X, Y, Z, for each 16 minutes.	3
Static Electricity Test	Endurance test apply the electric stress to the terminal.	VS=800V, RS=1.5kΩ, CS=100pF, 1 time.	-

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal. Temperature and humidity after remove from the rest chamber.

Note3: Test performed on product itself, not inside a container.

13 Warranty and Conditions

http://www.displaymodule.com/pages/faq HYPERLINK "http://www.displaymodule.com/pages/faq"