ORIENT DISPLAY

MAKE THINGS POSSIBLE

Specification for OLED

AOM12864A0-2.42YW-ANO

Revision A

AO	Orient Display Passive Matrix OLED
M	Monochrome
12864	Resolution 128 x 64
A0	Revision A0
2.42	Diagonal: 2.42’’, Module: 71.00 × 43.50 × 6.00 mm
Y	Yellow Character
W	Top: -40~+70°C; Tstr: -40~+85°C
ANO	4-line SPI/Compatible Arduino
/	All Viewing Angle
/	Controller SPD0301 Or Compatible

DOCUMENT REVISION HISTORY

Sample Version	Doc. Version	DATE	DESCRIPTION	CHECKEDBY
01	A	2019-9-26	Initial Released	

Contents

1. Basic Specifications

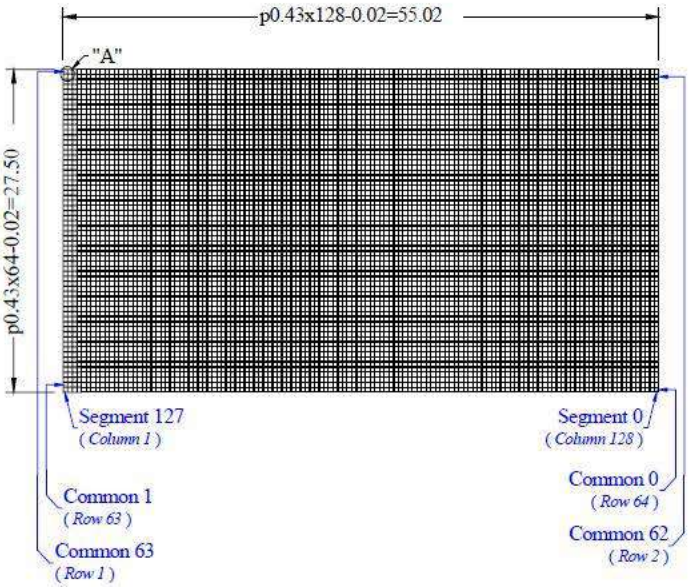
1.1 Display Specifications

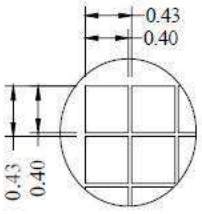
1)	Display Mode:	Passive Matrix
2)	Display Color:	Yellow
3)	Drive Duty:	1/64 Duty

1.2 Mechanical Specifications

1)	Outline Drawing:	According to the annexed outline drawing
2)	Number of Pixels:	128 × 64
3)	Modlue Size:	71.00×43.50 × 6.00max (mm)
4)	Active Area:	55.01 × 27.50(mm)
5)	Pixel Pitch:	0.43 × 0.43 (mm)
6)	Pixel Size:	0.40 × 0.40 (mm)
7)	Weight:	TBD

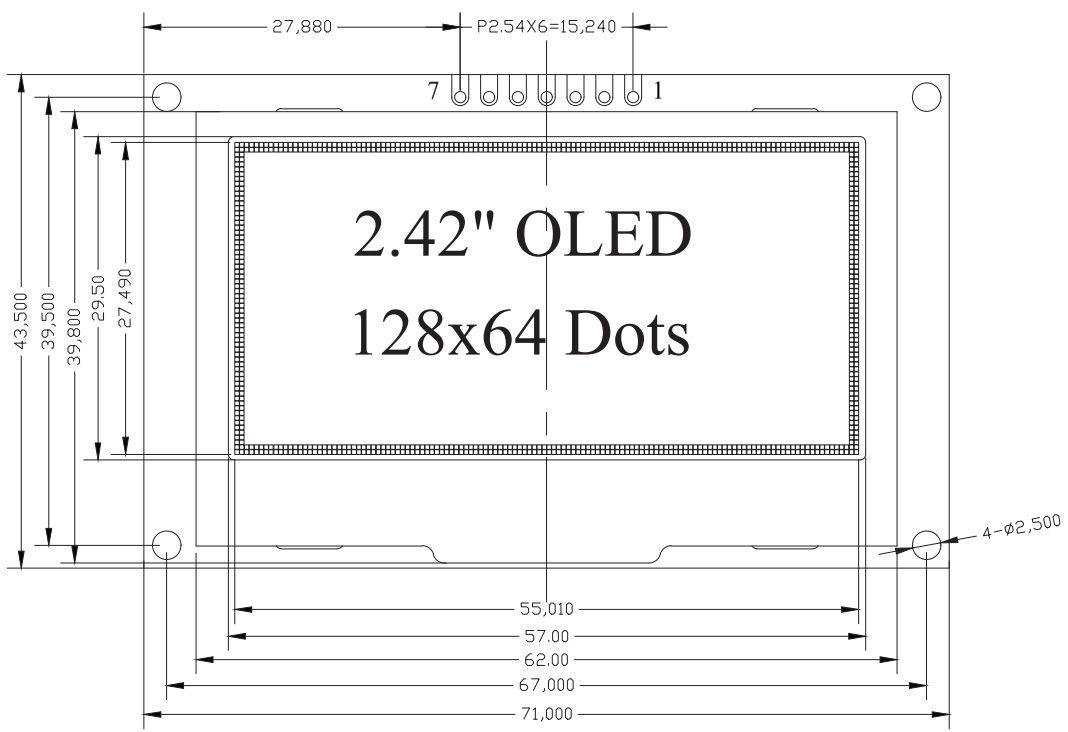
1.3 Active Area / Memory Mapping & Pixel Construction

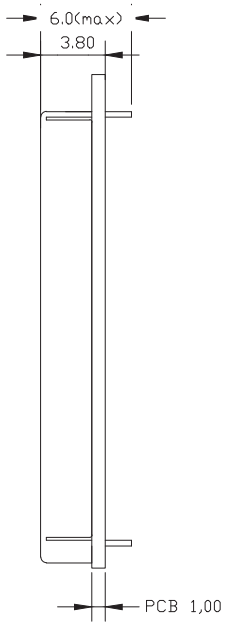




Detail "A"
Scale (10:1)

ITEAM	PARAMETERS	ITEAM	PARAMETERS	ITEAM	PARAMETERS	ITEAM	PARAMETERS
DISPLAY TYPE	PASSIVE MATRIX OLED	VIEWING DIRECTION	FREE	LCD OPERATING VOLTAGE	12V	IC	SPD0301
RESOLUTION (H*V)	2.42" 128*64 PIXELS	OPERATION TEMPERURE	-40°C TO +70°C	LOGIC VOLTAGE(VDD)	2.8V	BACKLIGHT	/
DISPLAY COLOR	YELLOW	STORAGE TEMPERATURE	-40°C TO +85°C	SURFACE LUMINANCE	110 Nits	CONNECTOR	SPI





NO	Symbol
1	GND
2	VDD
3	SCK
4	SDA
5	RES
6	DC
7	CS

ORIENT DISPLAY

TITLE	OLED	PART NO.		AOM12864A0-2.42YW-ANO	
REV.	V3.0	CUSTOMER NO.		AOM12864A0-2.42YW-ANO	
SCALE	FIT	UNIT	mm	3rd ANGLE	SHEET 1 of 1
ROHS/REACH COMPLIANT		YES		CUSTOMER'S APPROVAL	
UNMARKED TOLERANCE		±0.2			

REV.	SYMBOL	DESCRIPTION	DATE
V3.0		ALL COMPONENT ARE SAME ONE SIDE	SEP-26-2018
V2.0		CHANGE C3, C4 AND L1 POSITION	APR-26-2018
V1.0	-	FIRST ISSUE	JAN-17-2018

1.5 Pin Definition

PIN	SYMBOL	Descriptions
1	GND	Ground of Logic Circuit
2	VDD	Power Supply for Logic
3	SCK	Serial clock input.
4	SDA	Serial data input.
5	RST	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.
6	DC	This pin is Data/Command control pin. When the pin is pulled high and serial interface mode is selected, the data at SDIN will be interpreted as data. When it is pulled low, the data at SDIN will be transferred to the command register.
7	CS	Chip Select. Chip is selected when CS0 = "L".

2. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	V_{DD}	-0.3	4	V	1, 2
Supply Voltage for Display	V_{CC}	8	17	V	1, 2
Operating Temperature	T_{OP}	-40	70	°C	
Storage Temperature	T_{STG}	-40	85	°C	3
Life Time (220 cd/m^2)		13,000	-	hour	4(1)
Life Time (200 cd/m^2)		15,000	-	hour	4(2)
Life Time (180 cd/m^2)		16,000	-	hour	4(3)

Note 1: All the above voltages are on the basis of "V_{SS} = 0V".

Note 2: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also, for normal operations, it is desirable to use this module under the conditions according to Section 3. "Optics & Electrical Characteristics". If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

Note 3: The defined temperature ranges do not include the polarizer. The maximum withstood temperature of the polarizer should be 80°C.

Note 4: (1) Setting of 220 cd/m2 :
- Contrast setting : 0x44
- Frame rate : 105Hz
- Duty setting : 1/64

(2) Setting of 200 cd/m2 :
- Contrast setting : 0x3e
- Frame rate : 105Hz
- Duty setting : 1/64

(3) Setting of 180 cd/m2 :
- Contrast setting : 0x37
- Frame rate : 105Hz
- Duty setting : 1/64

3. Optics & Electrical Characteristics

3.1 DC Characteristics

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage for Logic	V_{DD}		1.65	2.8	3.3	V
Supply Voltage for Display	V_{CC}		11.5	12	12.5	V
High Level Input	V_{IH}		0.8×V_{DD}	-	-	V
Low Level Input	V_{IL}		-	-	0.2×V_{DD}	V
High Level Output	V_{OH}	I_{OUT} = 100μA, 3.3MHz	0.9×V_{DD}	-	-	V
Low Level Output	V_{OL}	I_{OUT} = 100μA, 3.3MHz	-	-	0.1×V_{DD}	V
VDD Supply Current VDD =2.8V, VCC = 12, IREF = 10uA , No Panel attached, Display ON, All ON,	I_{DD}	Contrast = FFh	-	90	110	μA
VCC Supply Current VDD = 2.8V, VCC =12, IREF =10uA, No Panel attached, Display ON, All ON	I_{CC}		-	450	580	μA
Segment Output Current, VDD = 2.8V, VCC =12V, IREF=10uA, Display ON.	I_{SEG}	Contrast=FFh	280	310	340	μA
		Contrast=AFh	-	215	-	
		Contrast=7Fh	-	155	-	
		Contrast=3Fh	-	78	-	
		Contrast=0Fh	20		-	
Sleep Mode Current for V_{DD}	$I_{DD, SLEEP}$	VDD = 1.65V~3.3V, VCC = 7V~16V Display OFF, No panel attached	-	-	10	μA
Sleep Mode Current for V_{CC}	$I_{CC, SLEEP}$	VDD = 1.65V~3.3V, VCC = 7V~16V Display OFF, No panel attached	-	-	10	μA

3.2 Electrical Specifications

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Normal mode current consumption		All pixels on	-	17	25	mA
Standby mode current consumption		Standby mode 10% pixels on	-	0.5	1.5	mA
Normal mode power consumption		All pixels on	-	71.5	97.5	mW
Standby mode power consumption		Standby mode 10% pixels on	-	6.5	19.5	mW
Brightness	L_{br}	-	90	110	-	cd/m^2
C.I.E. (White)	(x) (y)	C.I.E. 1931	0.24 0.28	0.28 0.32	0.32 0.36	
Dark Room Contrast	CR	-	2000:1	-	-	
Viewing Angle		-	160	-	-	degree

*Note:
VDD is 2.8V,set VDD selection (0xad)=(0x40),
VDD is 1.8V,set VDD selection (0xad)=(0x60) contrast setting is shown below.

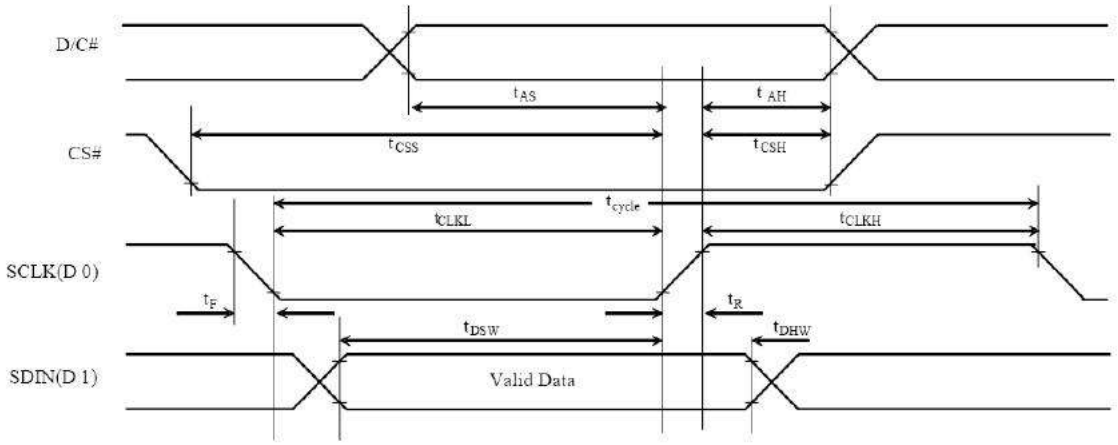
(1) Normal mode condition :
- Driving Voltage : 12V
- Contrast setting : 0x3e
- Frame rate : 105Hz
- Duty setting : 1/64

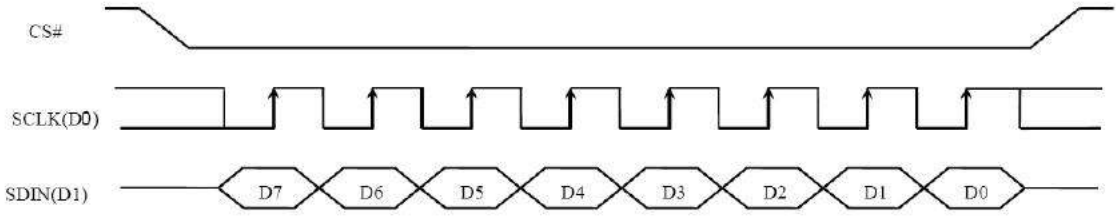
(2) Standby mode condition :
- Driving Voltage : 12V
- Contrast setting : 0x00
- Frame rate : 105Hz
- Duty setting : 1/64

3.3 Serial Interface Timing Characteristics: (4-wire SPI)

Symbol	Description	Min	Max	Unit
t_{cycle}	Clock Cycle Time	250	-	ns
t_{AS}	Address Setup Time	150	-	ns
t_{AH}	Address Hold Time	150	-	ns
t_{CSS}	Chip Select Setup Time	120	-	ns
t_{CSH}	Chip Select Hold Time	60	-	ns
t_{DSW}	Write Data Setup Time	50	-	ns
t_{DHW}	Write Data Hold Time	15	-	ns
t_{CLKL}	Clock Low Time	100	-	ns
t_{CLKH}	Clock High Time	100	-	ns
t_R	Rise Time	-	15	ns
t_F	Fall Time	-	15	ns

* (V_{DD} - V_{SS} = 1.65V to 3.3V, VDD=VDDIO,T_a = 25°C)





4. Functional Specification

4.1 Commands

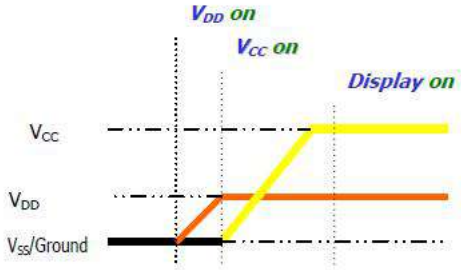
Refer to the Technical Manual for the SSD1309

4.2 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.

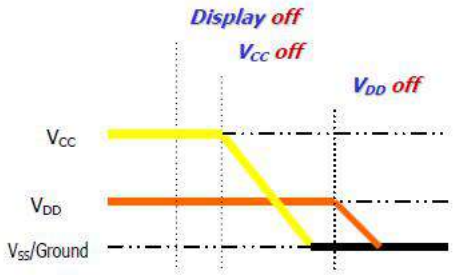
4.2.1 Power up Sequence:

1. Power up V_{DD}
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



4.2.2 Power down Sequence:

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



Note 13:

1) Since an ESD protection circuit is connected between V_{DD} and V_{CC} inside the driver IC, V_{CC} becomes lower than V_{DD} whenever V_{DD} is ON and V_{CC} is OFF.
2) V_{CC} should be kept float (disable) when it is OFF.
3) Power Pins (V_{DD}, V_{CC}) can never be pulled to ground under any circumstance.
4) V_{DD} should not be power down before V_{CC} power down.

4.3 Reset Circuit

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

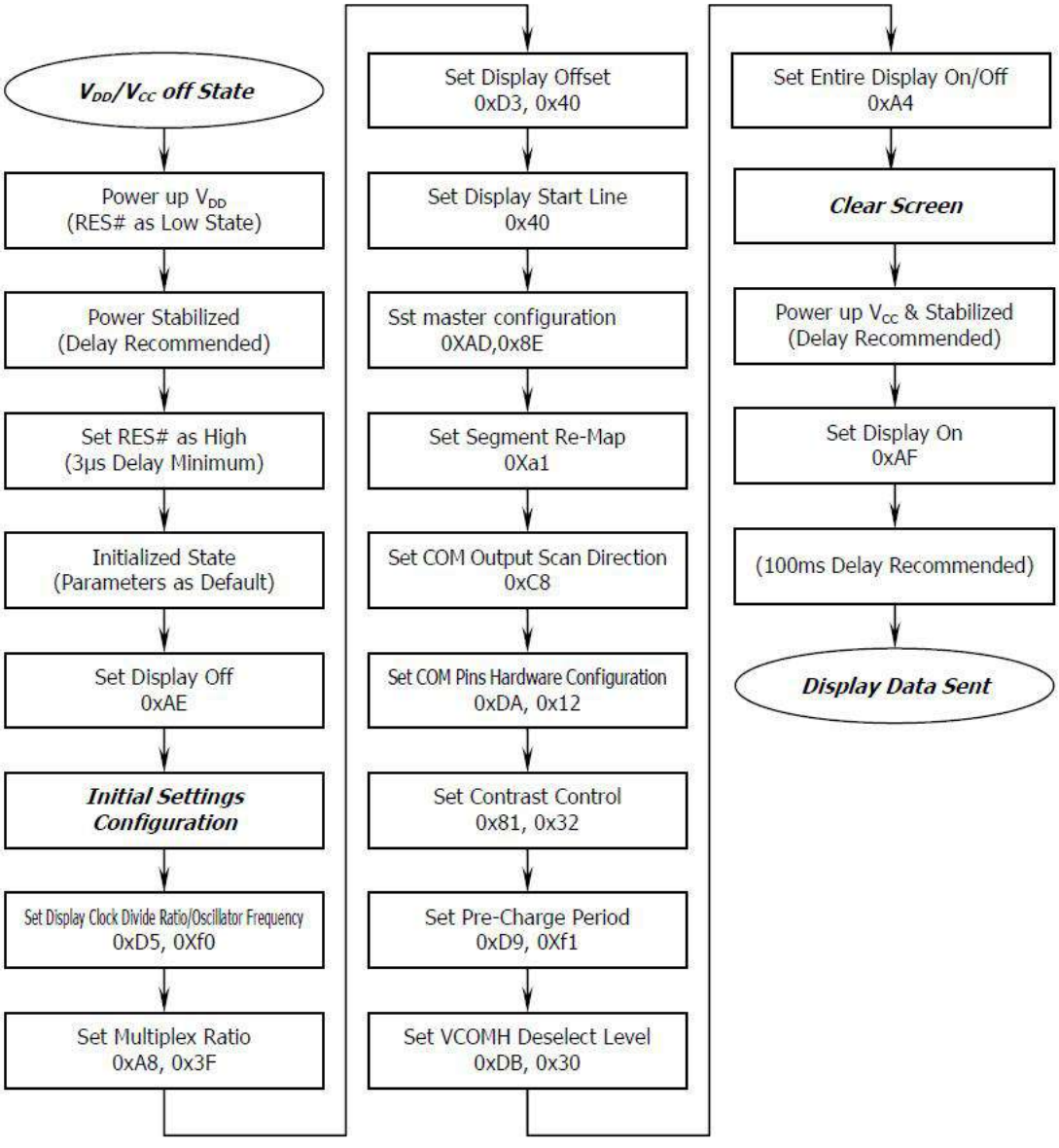
1. Display is OFF
2. 128×64 Display Mode
3. Normal segment and display data column and row address mapping (SEG0 mapped to column address 00h and COM0 mapped to row address 00h)
4. Shift register data clear in serial interface
5. Display start line is set at display RAM address 0
6. Column address counter 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)

4.4 Actual Application Example

Command usage and explanation of an actual example

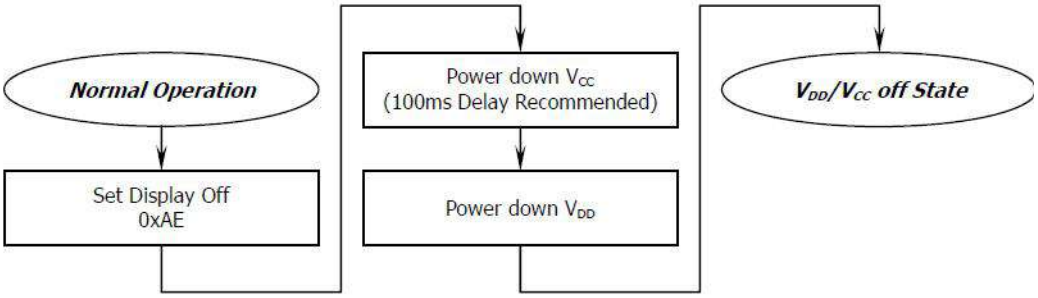
4.4.1 V_{CC} Supplied Externally

<Power up Sequence>

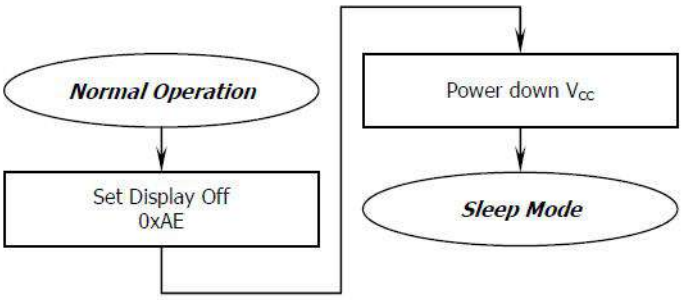


If the noise is accidentally occurred at the displaying window during the operation, please reset the display in order to recover the display function.

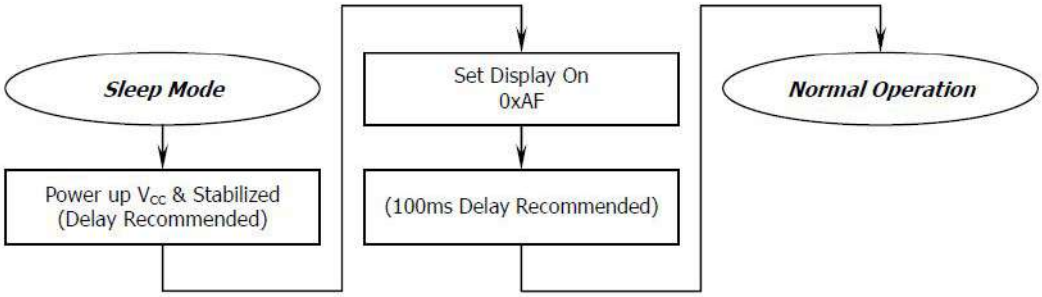
<Power down Sequence>



<Entering Sleep Mode>



<Exiting Sleep Mode>



External setting

```
  void SSD1309 ()
  {
      RES=0;
      delay(1000);
      RES=1;
      delay(1000);

      write_i(0xae); /* set   display off */

      write_i(0x00); /* set   lower column start address */
      write_i(0x10); /* set   higher column start address */

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

      write_i(0x81); /* set   contrast control */
      write_i(0x32);
```

```
    write_i(0xa1); /* set   segment remap    */

    write_i(0xa6); /* set   normal display */

    write_i(0xa8); /* set   multiplex ratio */
    write_i(0x3f); /* 1/64 */

    write_i(0xc8); /* set   com scan direction */

    write_i(0xd3); /* set   display offset    */
    write_i(0x00);

    write_i(0xd5); /* set   display clock divide/oscillator frequency */
    write_i(0xa0);

    write_i(0xD9);
    write_i(0xF1);

    write_i(0xda); /* set   com pin configuartion */
    write_i(0x12);

    write_i(0x91);
    write_i(0x3F);
     write_i(0x3F);
       write_i(0x3F);
         write_i(0x3F);

    write_i(0xaf); /* set   display on */
}

void write_i(unsigned char ins)
{
    RS=0;
    CS=0;
    WR=0;
    P1=ins;
    WR=1;
    CS=1;
}

void write_d(unsigned char dat)
{
    RS=1;
    CS=0;
    WR=0;
    P1=dat;
    WR=1;
    CS=1;
}
```

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

5. Reliability

5.1 Contents of Reliability Tests

Item	Conditions	Criteria
High Temperature Operation	70°C, 240 hrs	The operational functions work.
Low Temperature Operation	-40°C,120 hrs	
High Temperature Storage	85°C, 120 hrs	
Low Temperature Storage	-40°C, 120 hrs	
High Temperature/Humidity Operation	65°C, 90% RH, 120 hrs	
Thermal Shock	-40°C ~85°C (-40°C /30min; transit /3min; 85°C /30min; transit/3min) 1cycle: 66min, 100 cycles	

* The samples used for the above tests do not include polarizer.
* No moisture condensation is observed during tests.

5.2 Failure Check Standard

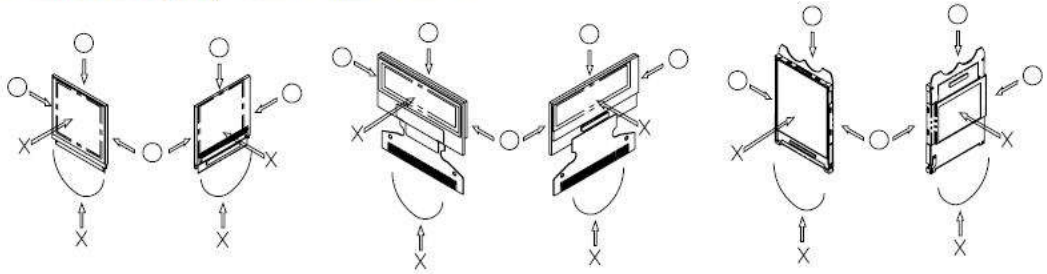
After the completion of the described reliability test, the samples were left at room temperature for 2 hrs prior to conducting the failure test at 23±5°C; 55±15% RH.

8. Precautions When Using These OEL Display Modules

8.1 Handling Precautions

1) Since the display panel is being made of glass, do not apply mechanical impacts such us dropping from a high position.
2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
3) If pressure is applied to the display surface or its neighborhood of the OEL display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
4) The polarizer covering the surface of the OEL display module is soft and easily scratched. Please be careful when handling the OEL display module.
5) When the surface of the polarizer of the OEL display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
   * Scotch Mending Tape No. 810 or an equivalent

   Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
   Also, pay attention that the following liquid and solvent may spoil the polarizer:
   * Water
   * Ketone
   * Aromatic Solvents
6) Hold OEL display module very carefully when placing OEL display module into the system housing. Do not apply excessive stress or pressure to OEL display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.



7) Do not apply stress to the driver IC and the surrounding molded sections.
8) Do not disassemble nor modify the OEL display module.
9) Do not apply input signals while the logic power is off.
10) Pay sufficient attention to the working environments when handing OEL display modules to prevent occurrence of element breakage accidents by static electricity.
    * Be sure to make human body grounding when handling OEL display modules.
    * Be sure to ground tools to use or assembly such as soldering irons.
    * To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
    * Protective film is being applied to the surface of the display panel of the OEL display module. Be careful since static electricity may be generated when exfoliating the protective film.
11) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the OEL display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
12) If electric current is applied when the OEL display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

8.2 Storage Precautions

1) When storing OEL display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high humidity environment or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Allvision technology Inc.) At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
2) If electric current is applied when water drops are adhering to the surface of the OEL display module, when the OEL display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

8.3 Designing Precautions

1) The absolute maximum ratings are the ratings which cannot be exceeded for OEL display module, and if these values are exceeded, panel damage may be happen.
2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the V_{IL} and V_{IH} specifications and, at the same time, to make the signal line cable as short as possible.
3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (V_{DD}). (Recommend value: 0.5A)
4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
5) As for EMI, take necessary measures on the equipment side basically.
6) When fastening the OEL display module, fasten the external plastic housing section.
7) If power supply to the OEL display module is forcibly shut down by such errors as taking out the main battery while the OEL display panel is in operation, we cannot guarantee the quality of this OEL display module.
8) The electric potential to be connected to the rear face of the IC chip should be as follows: SH1106
   * Connection (contact) to any other potential than the above may lead to rupture of the IC.

8.4 Precautions when disposing of the OEL display modules

1) Request the qualified companies to handle industrial wastes when disposing of the OEL display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

8.5 Other Precautions

1) When an OEL display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur.
   Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.
2) To protect OEL display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the OEL display modules.
   * Pins and electrodes
   * Pattern layouts such as the FPC
3) With this OEL display module, the OEL driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this OEL driver is exposed to light, malfunctioning may occur.
   * Design the product and installation method so that the OEL driver may be shielded from light in actual usage.
   * Design the product and installation method so that the OEL driver may be shielded from light during the inspection processes.
4) Although this OEL display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may

be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.

5) We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.