Display Future Ltd
www.displayfuture.com

LCD MODULE SPECIFICATION

Model: DF-GON0091WB-M1

This module uses ROHS materials

For customer acceptance

Customer		date
Approved		
Comments		

The standard product specification may change without prior notice in order to improve performance or quality. Please contact Display Future Ltd for updated specification and product status before design for the standard product or release of the order.	Revision	1.0
	Engineering	
	Date	2018/01/4
	Our Reference	

REVISION RECORD

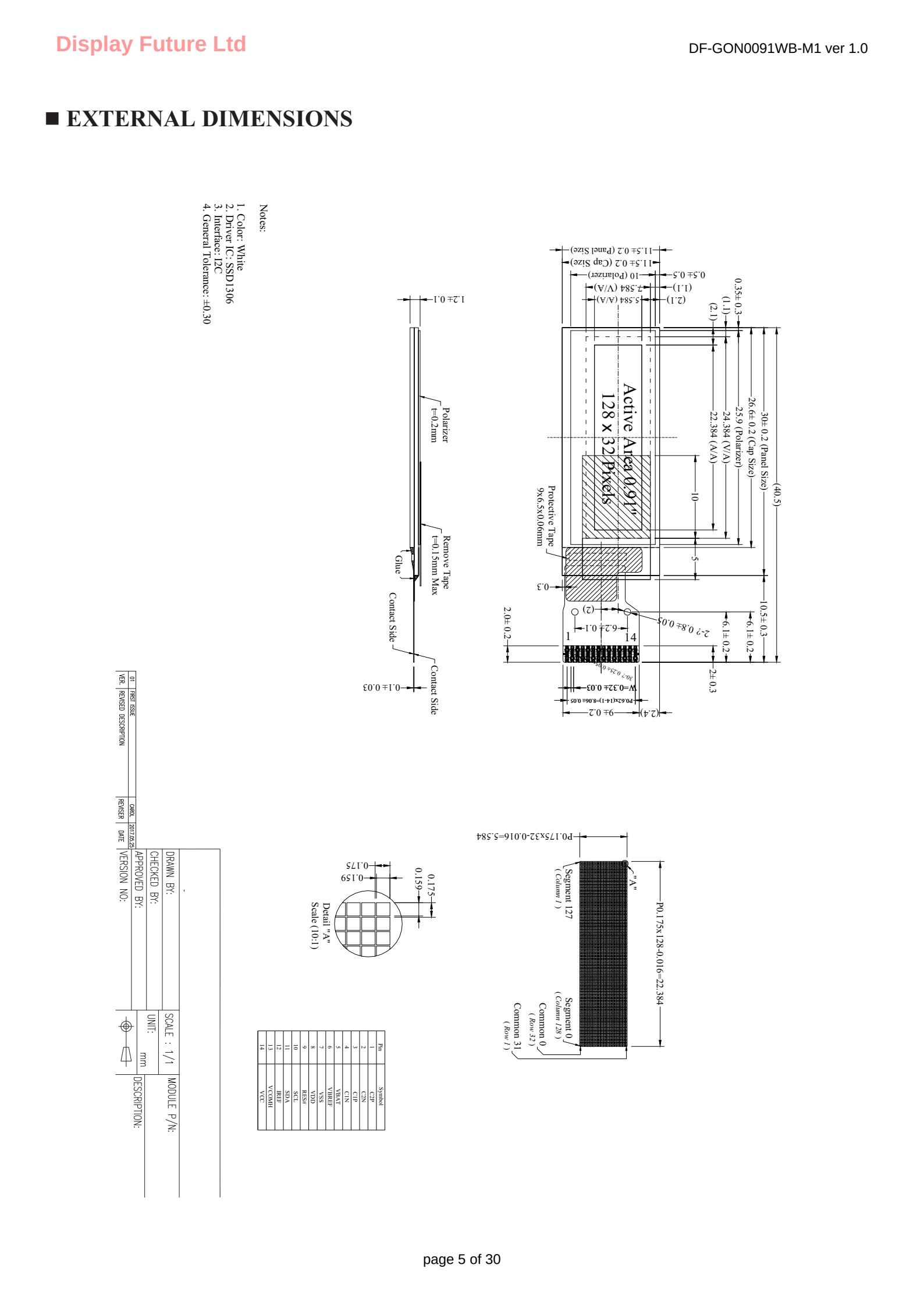
REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2017-05-25	First release	

CONTENT

■ PHYSICAL DATA

No.	Items	Specification	Unit
1	Display Mode	Passive Matrix OLED	-
2	Display Color	Monochrome (White)	-
3	Duty	1/32	-
4	Resolution	128(H) x 32 (V)	Pixel
5	Active Area	22.384 (W)x 5.584 (H)	mm^2
6	Outline Dimension	30.00 (W) x 11.50 (H) x 1.20 (D)	mm^3
7	Pixel Pitch	0.175 (W) x 0.175 (H)	mm^2
8	Pixel Size	0.159 (W) x 0.159 (H)	mm^2
9	Driver IC	SSD1306	-
10	Interface	I2C	-
11	Weight	TBD	g

■ EXTERNAL DIMENSIONS



■ ABSOLUTE MAXIMUM RATINGS

Items	Symbol	Min	Max	Unit	Notes
Supply voltage for logic	V_{DD}	-0.3	4	V	1,2
Supply voltage for display	V_{CC}	0	16.0	V	1,2
Supply voltage for DC/DC	V_{BAT}	-0.3	4.3	V	1,2
Operating temperature	T_{OP}	-40	85	℃	3
Storage temperature	T_{ST}	-40	85	℃	3
Life time(120cd/m²)	-	10000	-	hour	4
Life time(80cd/m²)	-	30000	-	hour	4
Life time(60cd/m²)	-	50000	-	hour	4

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 electro-optical 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 temperature of the polarizer should be 80°C.

Note 4: V_{CC} = 7.25,Ta=25°C,50% Checkerboard.
Software configuration follows Actual Application Example .
End of lifetime is specified as 50% of initial brightness reached.The average operating lifetime at room temperature is estimated by the accelerated operation at high temperature conditions.

■ ELECTRICAL CHARACTERISTICS

◆DC Characteristics

1. VCC Supplied Externally

Items	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}	Note 5	6.4	-	9.0	V
High level input	V_{IH}	I_{OUT} = 100μA, 3.3MH	0.8 x V_{DD}	-	V_{DD}	V
Low level input	V_{IL}	I_{OUT} = 100μA, 3.3MH	0	-	0.2 x V_{DD}	V
High level output	V_{OH}	I_{OUT} = 100μA, 3.3MH	0.9 x V_{DD}	-	V_{DD}	V
Low level output	V_{OL}	I_{OUT} = 100μA, 3.3MH	0	-	0.1x V_{DD}	V
Operating current for V_{DD}	I_{DD}		-	180	300	μA
Operating current for V_{CC}	I_{CC}	Note 6	-	10	16	mA
Sleep mode current for V_{DD}	$I_{DD,SLEEP}$		-	1	5	μA
Sleep mode current for V_{CC}	$I_{CC,SLEEP}$		-	2	10	μA

Note 5: Supply Voltage for Display (V_{CC}) are subject to the change of the panel characteristics and the customer' s request.

Note 6: V_{DD} = 2.8V, V_{CC} = 7.25V, 100% Display Area Turn on.

* Software configuration follows Actual Application Example .

2. VCC Generated by Interface DC/DC Circuit

Items	Symbol	Conditions	Min	Typ.	Max	Unit
Supply voltage for logic	V_{DD}		1.65	2.8	3.3	V
Supply voltage for DC/DC	V_{BAT}		3.5	-	4.2	V
Supply voltage for display	V_{CC}	Note 7	7.0	7.25	7.5	V
High level input	V_{IH}	I_{OUT} = 100μA, 3.3MH	0.8 x V_{DD}	-	V_{DD}	V
Low level input	V_{IL}	I_{OUT} = 100μA, 3.3MH	0	-	0.2 x V_{DD}	V
High level output	V_{OH}	I_{OUT} = 100μA, 3.3MH	0.9 x V_{DD}	-	V_{DD}	V
Low level output	V_{OL}	I_{OUT} = 100μA, 3.3MH	0	-	0.1x V_{DD}	V
Operating current for V_{DD}	I_{DD}		-	180	300	μA
Operating current for V_{BAT}	I_{BAT}	Note 8	-	18	23	mA
Sleep mode current for V_{DD}	$I_{DD,SLEEP}$		-	1	5	μA
Sleep mode current for V_{CC}	$I_{CC,SLEEP}$		-	2	10	μA

Note 7: Supply Voltage for Display (V_{CC}) are subject to the change of the panel characteristics and the customer' s request.

Note 8: V_{DD} = 2.8V, V_{CC} = 7.25V,100% Display Area Turn on.

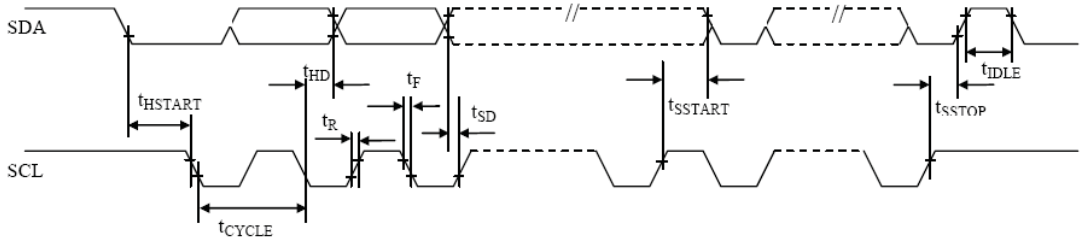
* Software configuration follows Actual Application Example .

◆AC Characteristics

1. I^2C Interface Timing Characteristics:

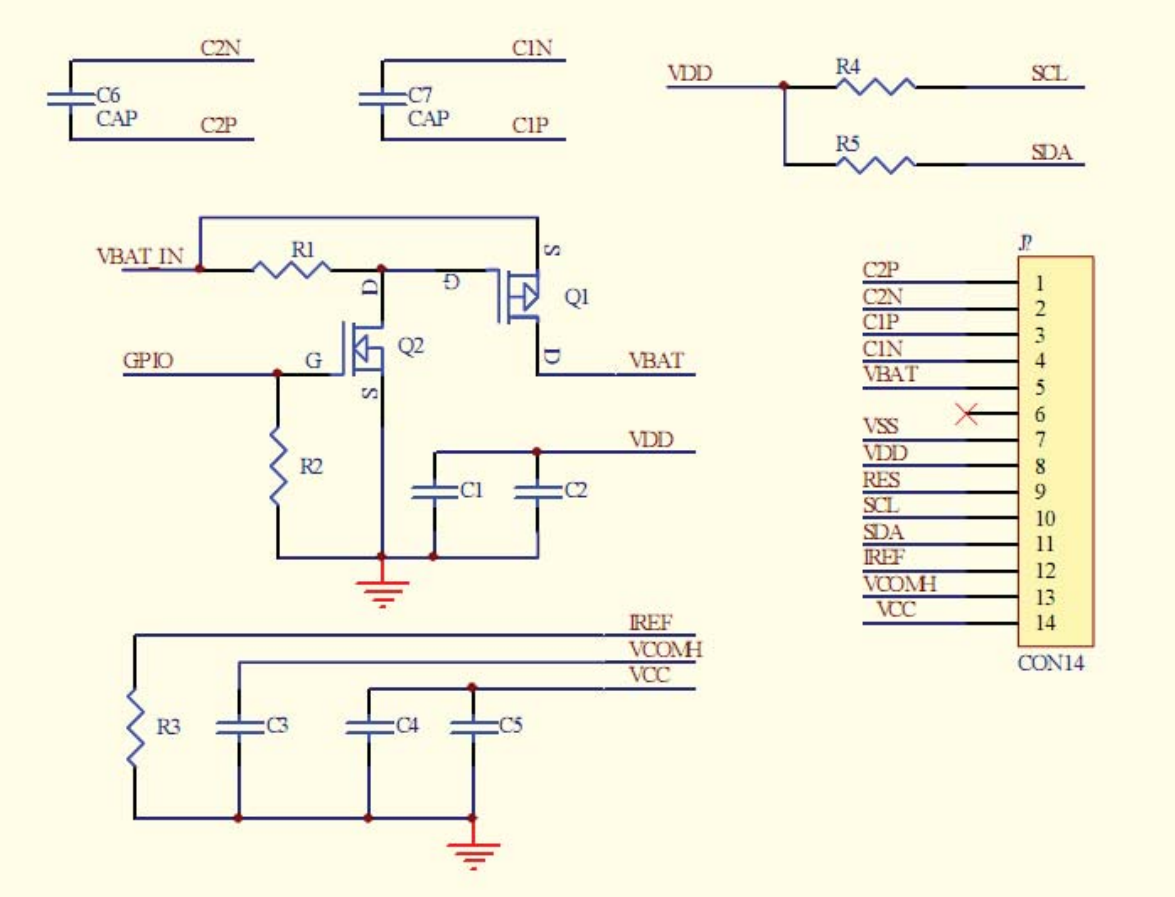
Symbol	Description	Min	Max	Unit
t_{cycle}	Clock Cycle Time	2.5	-	μs
t_{HSTART}	Start Condition Hold Time	0.6	-	μs
t_{HD}	Data Hold Time (for "SDA_{OUT}" Pin)	0	-	ns
	Data Hold Time (for "SDA_{IN}" Pin)	300		
t_{SD}	Data Setup Time	100	-	ns
t_{SSTART}	Start Condition Setup Time (Only relevant for a repeated 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

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



1.1 I²C Interface With Internal Charge Pump:

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



Recommended Components:

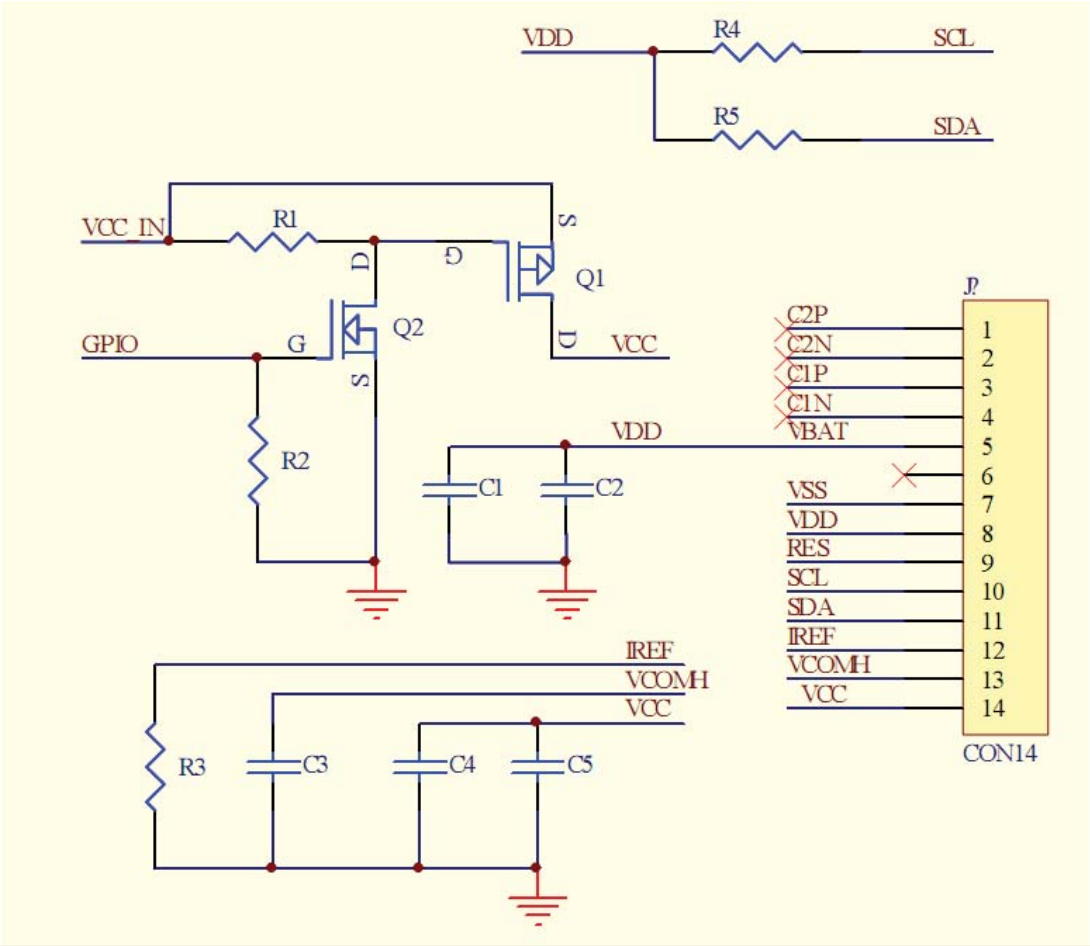
C1,:	0.1μF / 6.3V, X5R
C2:	4.7μF / 6.3V, X5R
C3:	2.2μF/ 16V, X7R
C4:	4.7μF / 16V, X7R
C5:	0.1μF / 16V, X7R
C6,C7:	1μF / 16V, X7R
R3:	560KΩ, R3 = (Voltage at IREF - VSS) / IREF
R2, R1:	47kΩ
R4, R5:	4. 7kΩ
Q1:	FDN338P
Q2:	FDN335N

Notes:

VDD:	1.65~3.3V, it should be equal to MPU I/O voltage.
VBAT_in:	3.5~4.2V

1.2 I²C Interface With External VCC

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



Recommended Components:

C1,:	0.1μF / 6.3V, X5R
C2:	4.7μF / 6.3V, X5R
C3:	2.2μF/ 16V, X7R
C4:	4.7μF / 16V, X7R
C5:	0.1μF / 16V, X7R
R3:	560KΩ, R3 = (Voltage at IREF - VSS) / IREF
R2, R1:	47kΩ
R4, R5:	4. 7kΩ
Q1:	FDN338P
Q2:	FDN335N

Notes:

VDD:	1.65~3.3V, it should be equal to MPU I/O voltage.
VCC_in:	7~7.5V

■ TIMING OF POWER SUPPLY

1. Commands

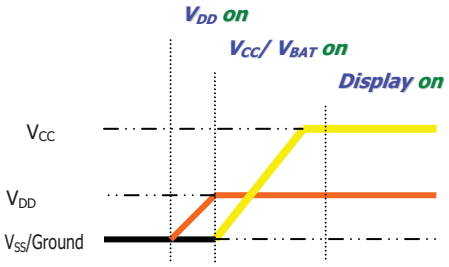
Refer to the Technical Manual for the SSD1306

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.

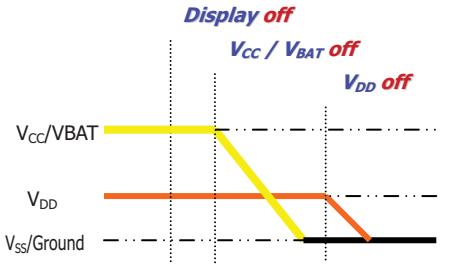
2.1 Power up Sequence:

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



2.2 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}



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}/ V_{BAT} should be kept float (disable) when it is OFF.
3) Power Pins (V_{DD}, V_{CC}, V_{BAT}) can never be pulled to ground under any circumstance.
4) V_{DD} should not be power down before V_{CC} / V_{BAT} power down.

3. Reset Circuit

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

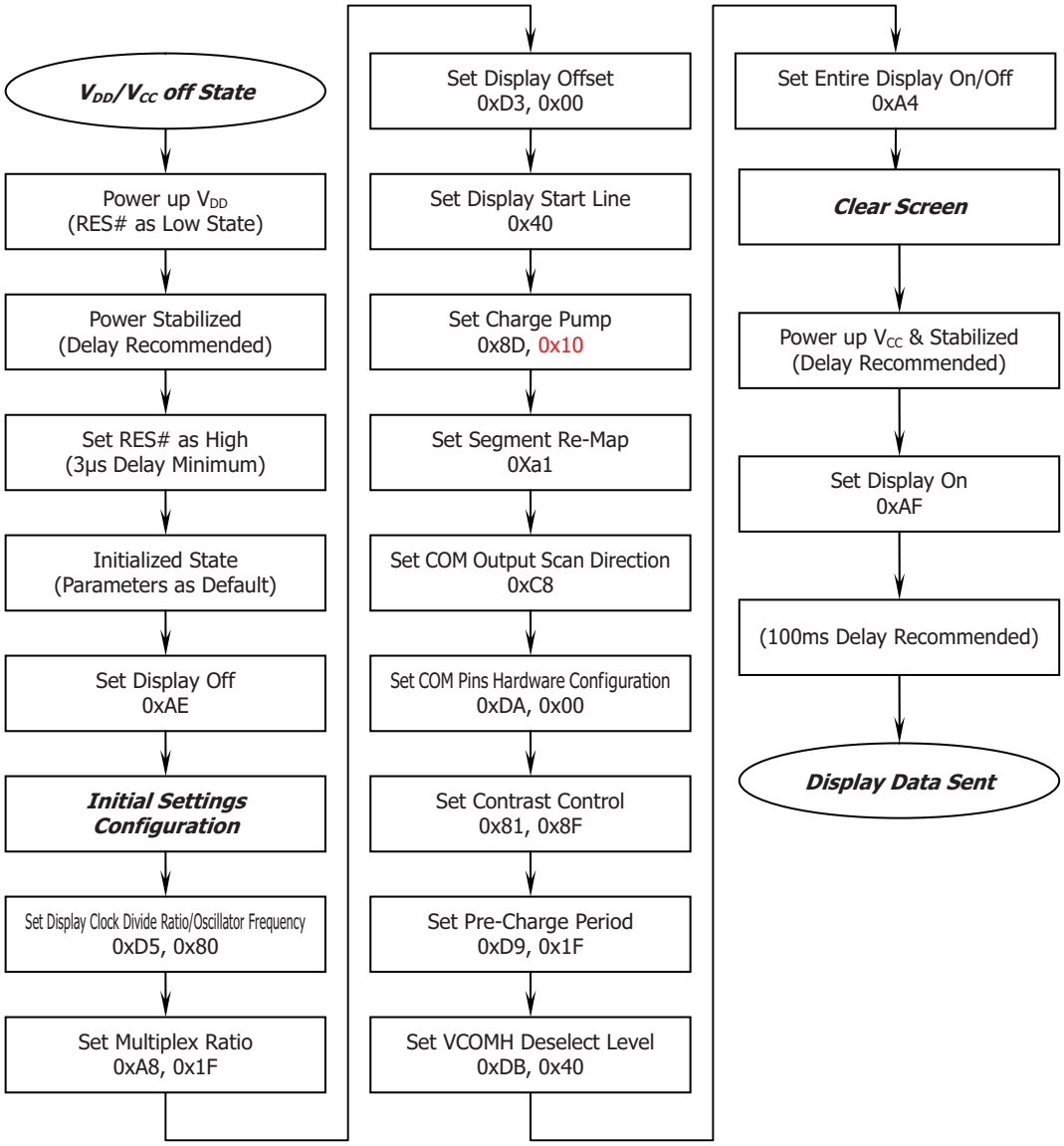
1. Display is OFF
2. 128×32 Display Mode
3. Normal segment and display data column and row address mapping (SEG0 mapped to column address 00h and COM0 mapped to row address 00h)
4. Shift register data clear in serial interface
5. Display start line is set at display RAM address 0
6. Column address counter 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. Actual Application Example

Command usage and explanation of an actual example

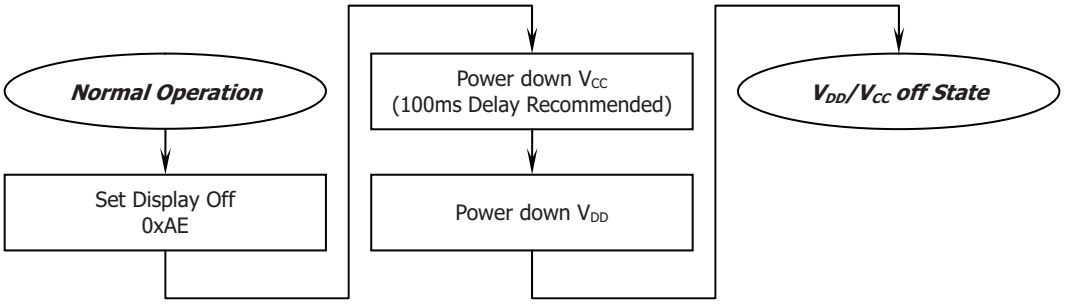
4.1 V_{CC} Supplied Externally

<Power up Sequence>

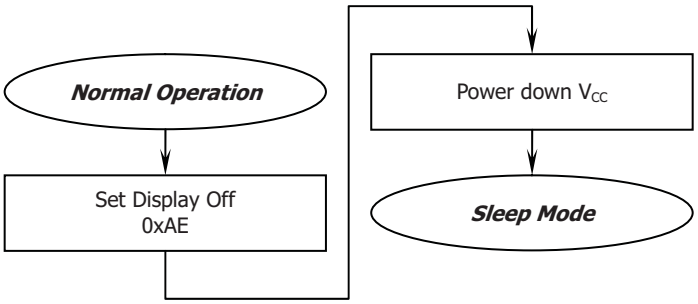


If the noise is accidentally occurred at the displaying window during the operation, please reset the display in order to recover the display function.

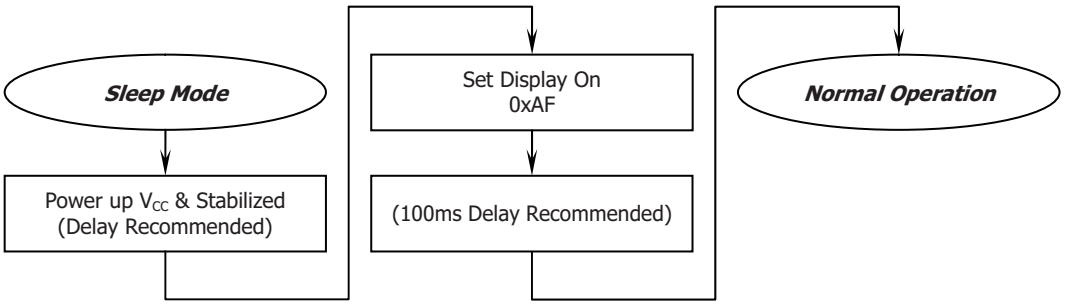
<Power down Sequence>



<Entering Sleep Mode>



<Exiting Sleep Mode>



External setting

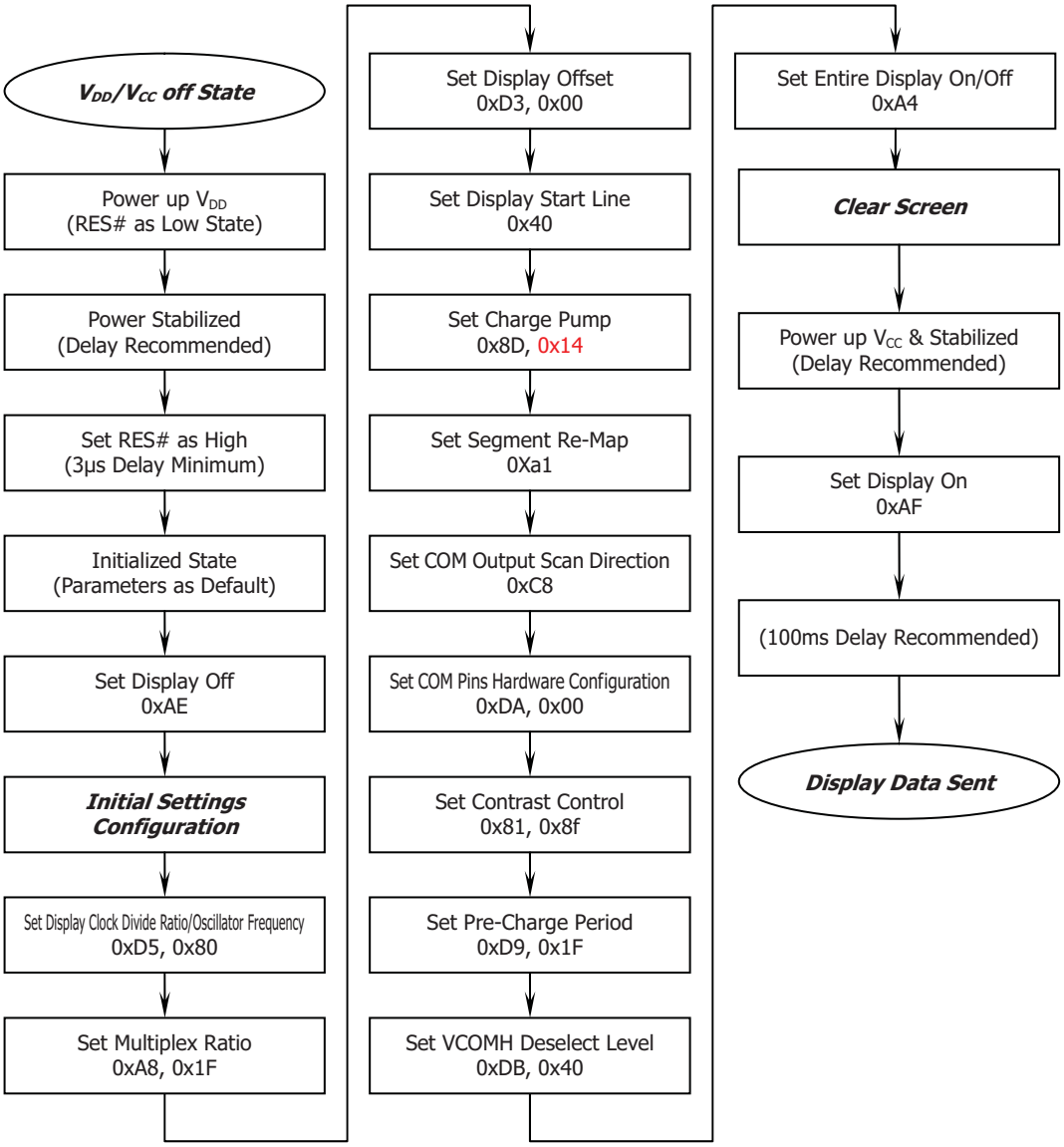
```
void SSD1306()
{
    RES=0;
    delay(1000);
    RES=1;
    delay(1000);

      write_i(0xAE);      /*display off*/

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

      write_i(0x00);      /*set display start line*/

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

```
        write_i(0x81);      /*contract control*/
        write_i(0x8f);      /*128*/

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

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

        write_i(0xA8);      /*multiplex ratio*/
        write_i(0x1F);      /*duty = 1/32*/

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

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

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

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

        write_i(0xDA);      /*set COM pins*/
        write_i(0x00);

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

        write_i(0x8d);      /*set charge pump enable*/
        write_i(0x10);

        write_i(0xAF);      /*display ON*/
 }
void write_w(unsigned char dat)
{
    unsigned char m,da;
    unsigned char j;
    da=dat;
    for(j=0;j<8;j++)
    {
      m=da;
      SCL=0;
      m=m&0x80;
      if(m==0x80)
         {
           SDA=1;
         }
      else
         {
```

```
            SDA=0;
          }
       da=da<<1;
       SCL=1;
      }
      SCL=0;
      SCL=1;
}

void write_i(unsigned char ins)
{    start();
    write_w(0x78);
    write_w(0x00);
    write_w(ins);
    stop();
}
void write_d(unsigned char dat)
{
    start();
    write_w(0x78);
    write_w(0x40);
    write_w(dat);
    stop();
}

 void   start()
{
  SCL=1;
  SDA=1;
  SDA=0;
  SCL=0;
}

void   stop()
{
  SCL=0;
  SDA=0;
  SDA=1;
  SCL=1;
}

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

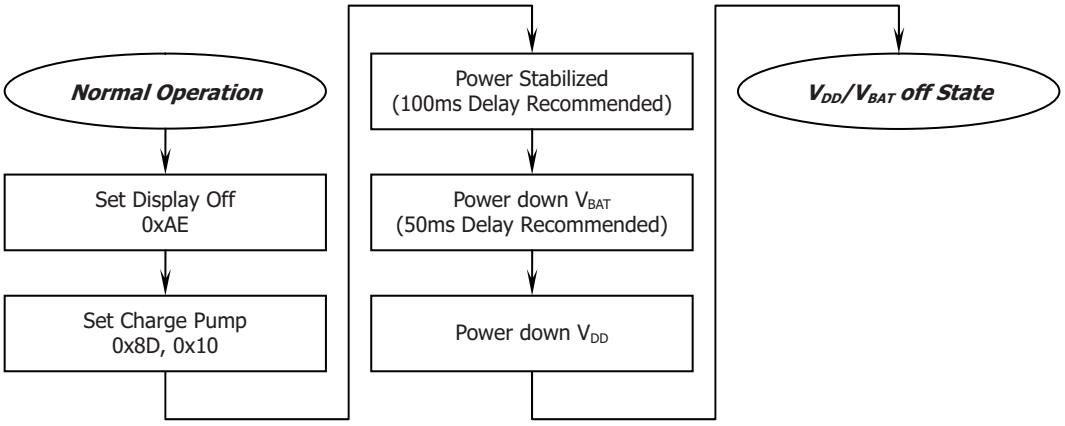
4.2 V_{CC} Generated by Internal DC/DC Circuit

<Power up Sequence>

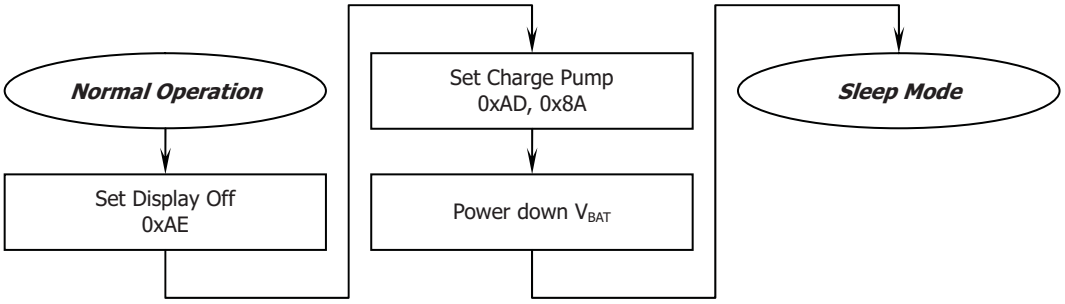


If the noise is accidentally occurred at the displaying window during the operation, please reset the display in order to recover the display function.

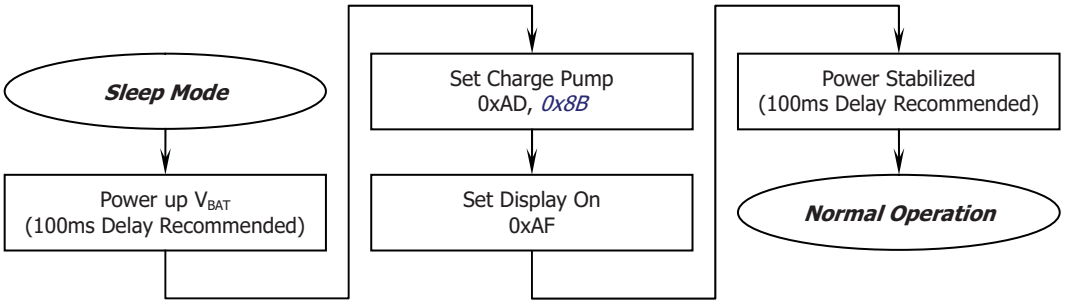
<Power down Sequence>



<Entering Sleep Mode>



<Exiting Sleep Mode>



Internal setting（Charge pump）

```
void SSD1306()
{
    RES=0;
    delay(1000);
    RES=1;
    delay(1000);

      write_i(0xAE);      /*display off*/

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

```
        write_i(0x00);      /*set display start line*/

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

        write_i(0x81);      /*contract control*/
        write_i(0x8f);      /*128*/

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

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

        write_i(0xA8);      /*multiplex ratio*/
        write_i(0x1F);      /*duty = 1/32*/

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

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

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

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

        write_i(0xDA);      /*set COM pins*/
        write_i(0x00);

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

        write_i(0x8d);      /*set charge pump enable*/
        write_i(0x14);

        write_i(0xAF);      /*display ON*/
 }
void write_w(unsigned char dat)
{
    unsigned char m,da;
    unsigned char j;
    da=dat;
    for(j=0;j<8;j++)
    {
      m=da;
      SCL=0;
      m=m&0x80;
      if(m==0x80)
```

```
            {
              SDA=1;
            }
          else
            {
              SDA=0;
            }
          da=da<<1;
          SCL=1;
        }
        SCL=0;
        SCL=1;
}

void write_i(unsigned char ins)
{
    start();
    write_w(0x78);
    write_w(0x00);
    write_w(ins);
    stop();
}

void write_d(unsigned char dat)
{
    start();
    write_w(0x78);
    write_w(0x40);
    write_w(dat);
    stop();
}

 void   start()
{
  SCL=1;
  SDA=1;
  SDA=0;
  SCL=0;
}

void   stop()
{
  SCL=0;
  SDA=0;
  SDA=1;
  SCL=1;
}
```

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

■ ELECTRO-OPTICAL CHARACTERISTICS (Ta=25℃)

Items		Symbol	Min.	Typ.	Max.	Unit	Remark
Brightness (Vcc supplied externally)		Lbr	120	-	-	cd/m ^{2}	White
Brightness (Vcc generated by internal DC/DC)		Lbr	120	150	-	cd /m^2	White
Color Coordinate	White	CIE x	0.25	0.29	0.33	CIE1931	Darkroom
		CIE y	0.27	0.31	0.35		
Contrast Ratio*		Cr		2000:1	-		Darkroom
Viewing Angle Uniformity		△ θ	-	Free	-	Degree	-

Note : Brightness (L_{br}) is subject to the change of the panel characteristics and the customer' s request.

* Optical measurement taken at V_{DD} = 2.8V, V_{CC}= 7.25V.

Software configuration follows Actual Application Example .

■ INTERFACE PIN CONNECTIONS

1. Pin Definition

Pin Number	Symbol	I/O	Function
Power Supply			
8	VDD	P	**Power Supply for Logic** This is a voltage supply pin. It must be connected to external source.
7	VSS	P	**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.
14	VCC	P	**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 V_{SS} when the converter is used. It must be connected to external source when the converter is not used.
Driver			
12	IREF	I	**Current Reference for Brightness Adjustment** This pin is segment current reference pin. A resistor should be connected between this pin and V_{SS}. Set the current at 12.5μA maximum.
13	VCOMH	O	**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 V_{SS}.
DC/DC Converter			
5	VBAT	P	**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 V_{DD} when the converter is not used.
3 / 4 1 / 2	C1P / C1N C2P / C2N	I	**Positive Terminal of the Flying Inverting Capacitor** **Negative Terminal of the Flying Boost Capacitor** The charge-pump capacitors are required between the terminals. They must be floated when the converter is not used.
Interface			
9	RES#	I	**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.

2. Pin Definition (Continued)

Pin Number	Symbol	I/O	Function
Interface (Continued)			
10	SCL	I	**IIC Bus Clock Signal** The transmission if information in the I2C bus is following a clock sigmal. Each transmission of data bit is taken place during a single clock period of this pin.
11	SDA	I/O	**I2C Bus Data Signal** This pin acts as a communication channel between the transmitter and the receiver.
Reserve			
6	VBREF	-	NC

■ RELIABILITY TESTS

<table>
<tr><th colspan="2">Item</th><th>Condition</th><th>Criterion</th></tr>
<tr><td colspan="2">High Temperature Storage
(HTS)</td><td>85±2℃, 240 hours</td><td rowspan="6">1. After testing, the function test is ok.
2. After testing, no addition to the defect.
3. After testing, the change of luminance should be within +/- 50% of initial value.
4. After testing, the change for the mono and area color must be within (+/-0.02, +/- 0.02) and for the full color it must be within (+/-0.04, +/-0.04) of initial value based on 1931 CIE coordinates.
5. After testing, the change of total current consumption should be within +/- 50% of initial value.</td></tr>
<tr><td colspan="2">High Temperature Operating
(HTO)</td><td>85±2℃, 240 hours</td></tr>
<tr><td colspan="2">Low Temperature Storage
(LTS)</td><td>-40±2℃, 240 hours</td></tr>
<tr><td colspan="2">Low Temperature Operating
(LTO)</td><td>-40±2℃, 240 hours</td></tr>
<tr><td colspan="2">High Temperature / High Humidity Storage
(HTHHS)</td><td>60±3℃, 90%±3%RH, 120 hours</td></tr>
<tr><td colspan="2">Thermal Shock (Non-operation)
(TS)</td><td>-40±2℃ ~ 25℃ ~ 85±2℃
(30min) (5min) (30min)
24cycles</td></tr>
<tr><td>Vibration
(Packing)</td><td>10~55~10Hz,amplitude 1.5mm, 1 hour for each direction x, y, z</td><td colspan="2" rowspan="2">1. One box for each test.
2. No addition to the cosmetic and the electrical defects.</td></tr>
<tr><td>Drop
(Packing)</td><td>Height : 1 m, each time for 6 sides, 3 edges, 1 angle</td></tr>
</table>

Note： 1) For each reliability test, the sample quantity is 3, and only for one test item.
2) The HTHHS test is requested the Pure Water(Resistance＞10MΩ).

■ OUTGOING QUALITY CONTROL SPECIFICATION

1. Environment Required

Customer's test & measurement are required to be conducted under the following conditions:

Temperature:	23 ± 5°C
Humidity:	55 ± 15% RH
Fluorescent Lamp:	30W
Distance between the Panel & Lamp:	≥ 50cm
Distance between the Panel & Eyes of the Inspector:	≥ 30cm

Finger glove (or finger cover) must be worn by the inspector.
Inspection table or jig must be anti-electrostatic.

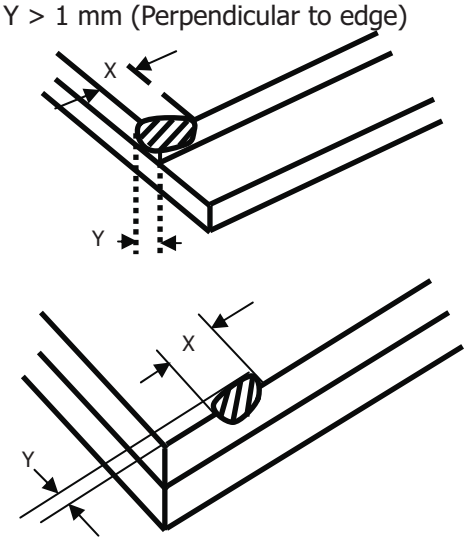
2. Sampling Plan

Level II, Normal Inspection, Single Sampling, MIL-STD-105E

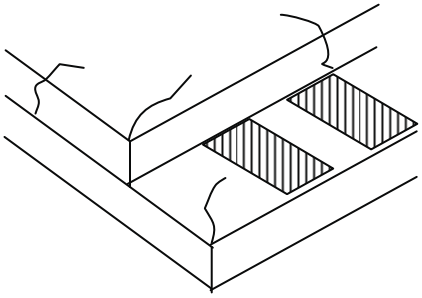
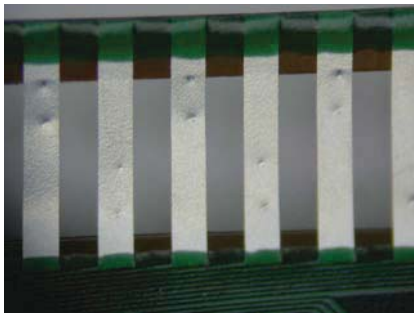
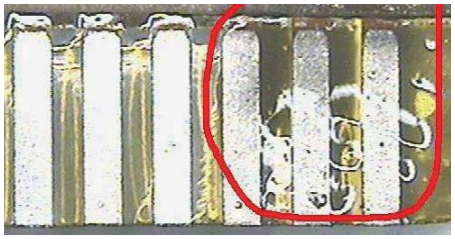
3. Criteria & Acceptable Quality Level

Partition	AQL	Definition
Major	0.65	Defects in Pattern Check (Display On)
Minor	1.0	Defects in Cosmetic Check (Display Off)

3.1 Cosmetic Check (Display Off) in Non-Active Area

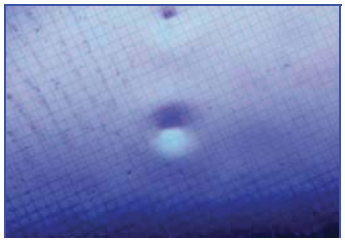
Check Item	Classification	Criteria
Panel General Chipping	Minor	X > 6 mm (Along with Edge) Y > 1 mm (Perpendicular to edge) 

3.2 Cosmetic Check (Display Off) in Non-Active Area (Continued)

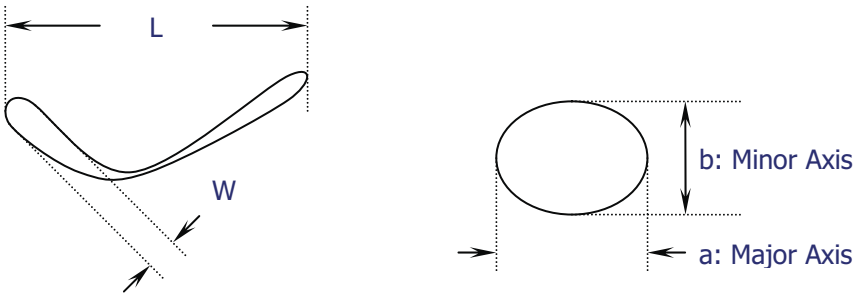
Check Item	Classification	Criteria
Panel Crack	Minor	Any crack is not allowable. 
Copper Exposed (Even Pin or Film)	Minor	Not Allowable by Naked Eye Inspection
Film or Trace Damage	Minor	
Terminal Lead Prober Mark	Acceptable	
Glue or Contamination on Pin (Couldn't Be Removed by Alcohol)	Minor	
Ink Marking on Back Side of panel (Exclude on Film)	Acceptable	Ignore for Any

3.3 Cosmetic Check (Display Off) in Active Area

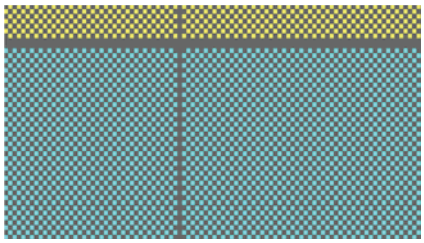
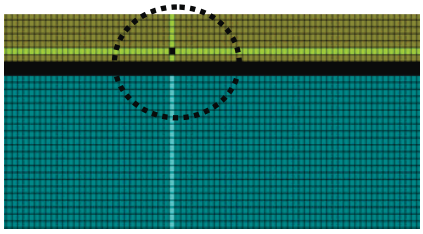
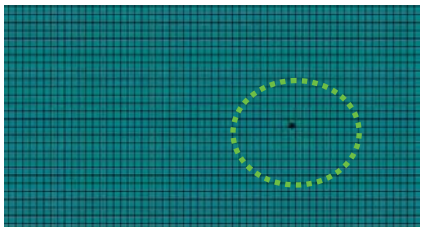
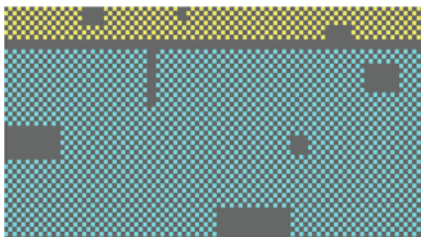
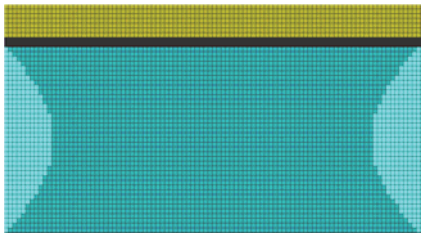
It is recommended to execute in clear room environment (class 10k) if actual in necessary.

Check Item	Classification	Criteria
Any Dirt & Scratch on Polarizer's Protective Film	Acceptable	Ignore for not Affect the Polarizer
Scratches, Fiber, Line-Shape Defect (On Polarizer)	Minor	W ≤ 0.1 Ignore W > 0.1 L ≤ 2 n ≤ 1 L > 2 n = 0
Dirt, Black Spot, Foreign Material, (On Polarizer)	Minor	Φ ≤ 0.1 Ignore 0.1 < Φ ≤ 0.25 n ≤ 1 0.25 < Φ n = 0
Dent, Bubbles, White spot (Any Transparent Spot on Polarizer)	Minor	Φ ≤ 0.5 ➔ Ignore if no Influence on Display 0.5 < Φ n = 0 
Fingerprint, Flow Mark (On Polarizer)	Minor	Not Allowable

* Protective film should not be tear off when cosmetic check.
** Definition of W & L & Φ (Unit: mm): Φ = (a + b) / 2



3.4 Pattern Check (Display On) in Active Area

Check Item	Classification	Criteria
No Display	Major	
Missing Line	Major	
Pixel Short	Major	
Darker Pixel	Major	
Wrong Display	Major	
Un-uniform	Major	

■ CAUTIONS IN USING OLED MODULE

◆Precautions For Handling OLED Module:

1. OLED module consists of glass and polarizer. Pay attention to the following items when handling:
   i. Avoid drop from high, avoid excessive impact and pressure.
   ii. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead.
   iii. If the surface becomes dirty, breathe on the surface and gently wipe it off with a soft dry cloth. If it is terrible dirty, moisten the soft cloth with Isopropyl alcohol or Ethyl alcohol. Other solvents may damage the polarizer. Especially water, Ketone and Aromatic solvents.
   iv. Wipe off saliva or water drops immediately, contact the polarizer with water over a long period of time may cause deformation.
   v. Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peeling-off may occur with high temperature and high humidity.
   vi. Condensation on the surface and the terminals due to cold or anything will damage, stain or dirty the polarizer, so make it clean as the way of iii.
2. Do not attempt to disassemble or process the OLED Module.
3. Make sure the TCP or the FPC of the Module is free of twisting, warping and distortion, do not pull or bend them forcefully, especially the soldering pins. On the other side, the SLIT part of the TCP is made to bend in the necessary case.
4. When assembling the module into other equipment, give the glass enough space to avoid excessive pressure on the glass, especially the glass cover which is much more fragile.
5. Be sure to keep the air pressure under 120 kPa, otherwise the glass cover is to be cracked.
6. Be careful to prevent damage by static electricity:
   i. Be sure to ground the body when handling the OLED Modules.
   ii. All machines and tools required for assembling, such as soldering irons, must be properly grounded.
   iii. Do not assemble and do no other work under dry conditions to reduce the amount of static electricity generated. A relative humidity of 50%-60% is recommended.
   iv. Peel off the protective film slowly to avoid the amount of static electricity generated.
   v. Avoid to touch the circuit, the soldering pins and the IC on the Module by the body.
   vi. Be sure to use anti-static package.
7. Contamination on terminals can cause an electrochemical reaction and corrade the terminal circuit, so make it clean anytime.
8. All terminals should be open, do not attach any conductor or semiconductor on the terminals.
9. When the logic circuit power is off, do not apply the input signals.
10. Power on sequence: V_{DD}(logic voltage) → V_{CC} (driving voltage), and power off sequence: V_{CC} (driving voltage) → V_{DD} (logic voltage).
11. Be sure to keep temperature, humidity and voltage within the ranges of the spec, otherwise shorten Module's life time, even make it damaged.
12. Be sure to drive the OLED Module following the Specification and Datasheet of IC

controller, otherwise something wrong may be seen.

13. When displaying images, keep them rolling, and avoid one fixed image displaying more than 30 seconds, otherwise the residue image is to be seen. This is the speciality of OLED.

◆Precautions For Soldering OLED Module:

1. Soldering temperature : 260°C ± 10°C.
2. Soldering time : 3-4 sec.
3. Repeating time : no more than 3 times.
4. If soldering flux is used, be sure to remove any remaining flux after finishing soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended to protect the surface with a cover during soldering to prevent any damage due to flux spatters.

◆ Precautions For Storing OLED Module:

1. If the module can not be used up in 3 months,make sure to seal the module in the vacuum bag with dessicant.
2. Store the Module in a dark place, do not expose to sunlight or fluorescent light.
3. The polarizer surface should not touch any other objects. It is recommended to store the Module in the shipping container.
4. It is recommended to keep the temperature between 0°C and 30°C , the relative humidity not over 60%.

◆ Limited Warranty

Unless agreed between with the customer, we will replace or repair any of its OLED modules which are found to be functionally defective when inspected in accordance with our OLED acceptance standards(copies available upon request) for a period of one year from date of production.Cosmetic/visual defects must be returned to us within 90 days of shipment. Confirmation of such date shall be based on data code on product. Our warranty liability to repair and/or replacement on the terms set forth above. We will not be responsible for any subsequent or consequential events.

◆Return OLED Module Under Warranty:

No warranty can be granted if the precautions stated above have been disregarded.The typical examples of violations are:

-Broken OLED glass.
-PCB eyelet is damaged or modified.
-PCB conductors damaged.
-Circuit modified in any way,including addition of components.
-PCB tampered with by grinding,engraving or painting varnish.
-Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement.Modules must be returned with sufficient description of the failures or defects.Any connectors or cable installed by the customer must be removed completely.

■ PRIOR CONSULT MATTER

1. ① For our standard products,we keep the right to change material,process ... for the product property without notice on our customer.
   ② For OEM products,if any change needed which may affect the product property,we will consult with our customer in advance.
2. If you have special requirement about reliability condition,please let us know before you start the test on our samples.