

Product Specification

Product Name:

Product Code: TSO7240-A01

Customer
Approved by Customer
Approved Date:

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1 Overview

IEO072040M1922 is a monochrome OLED display module with 72×40 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.

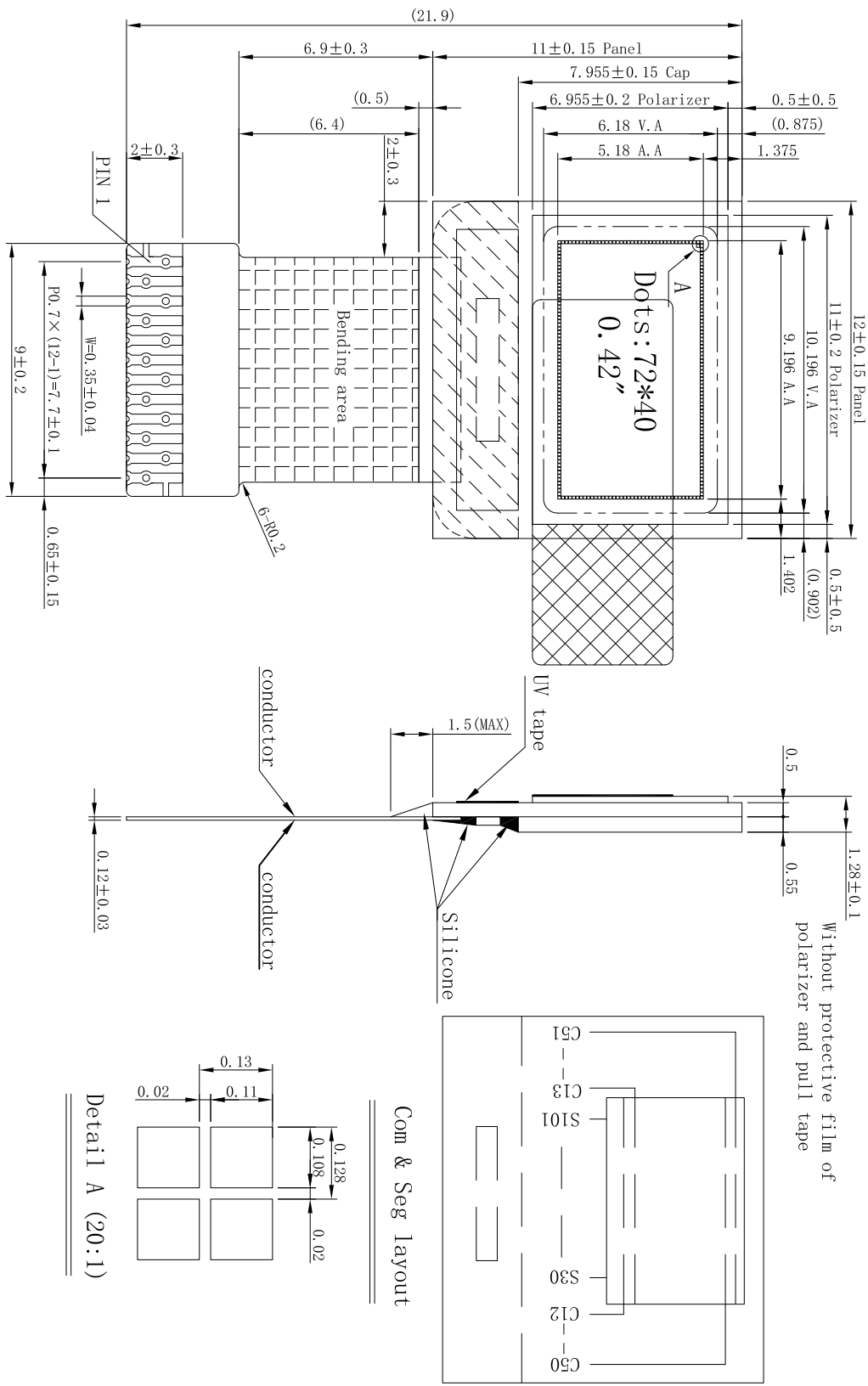
2 Features

- Display Color: White
- Dot Matrix: 72×40
- Driver IC: SH1106
- Interface: IIC
- Wide range of operating temperature: -40℃ to 70℃

3 Mechanical Data

NO.	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	72(W)×40(H)	-
2	Dot Size	0.108(W)×0.11(H)	mm ²
3	Dot Pitch	0.128(W)×0.13(H)	mm ²
4	Aperture Rate	71	%
5	Active Area	9.196 (W)×5.18 (H)	mm ²
6	Panel Size	12(W)×11 (H) ×1.05(T)	mm ³
7	Module Size	12(W)×19.9(H) ×1.28(T)	mm ³
8	Diagonal A/A Size	0.42	inch
9	Module Weight	0.37±10%	gram

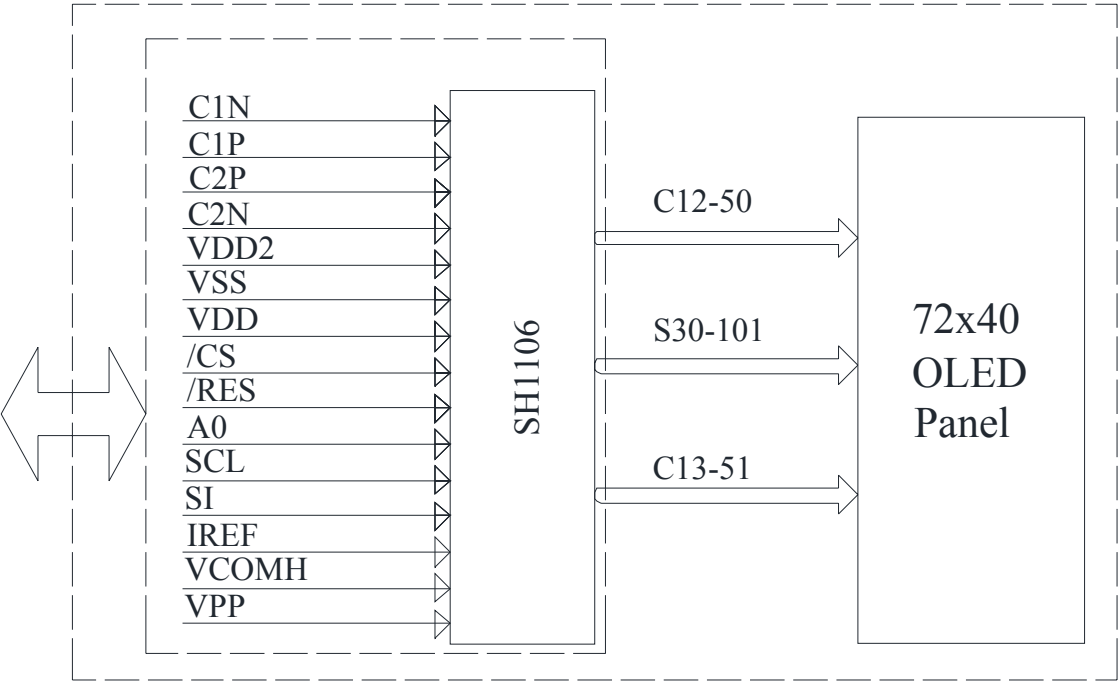
4 Mechanical Drawing



5 Module Interface

PIN NO.	PIN NAME	DESCRIPTION
1	C1N	C1P/C1N – Pin for charge pump capacitor; Connect to each other with a capacitor. C2P/C2N – Pin for charge pump capacitor; Connect to each other with a capacitor.
2	C1P	
3	C2P	
4	C2N	
5	VDD-3.3V	3.3V power supply pad for Power supply for charge pump circuit. This pin should be disconnected when VPP is supplied externally
6	VSS	This is a ground pin.
7	/RES	This is a reset signal input pad. When /RES is set to “L”, the settings are initialized. The reset operation is performed by the /RES signal level.
8	SCL	The serial clock input pad
9	SI	The serial data input pad
10	IREF	This is a segment current reference pad. A resistor should be connected between this pad and VSS.
11	VCOMH	This is a pad for the voltage output high level for common signals. A capacitor should be connected between this pad and VSS.
12	VPP	OLED panel power supply. Generated by internal charge pump. Connect to capacitor. It could be supplied externally.

6 **Function Block Diagram**



7 Absolute Maximum Ratings

ITEM	SYMBOL	MIN	MAX	UNIT	REMARK
Supply Voltage	VDD	-0.3	3.6	V	IC maximum rating
	VDD2	-0.3	4.8	V	IC maximum rating
OLED Operating Voltage	VPP	0	14.5	V	IC maximum rating
Operating Temp.	Top	-40	70	°C	-
Storage Temp	Tstg	-40	85	°C	-

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 8 “Electrical Characteristics”.

Malfunctioning of the module may occur and the reliability of the module may deteriorate if the module is used beyond the conditions.

8 Electrical Characteristics

8.1 DC Electrical Characteristics

ITEM	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Logic Supply Voltage	VDD -3.3	22±3°C, 55±15%R.H	3.0	3.3	3.5	V
OLED Driver Supply Voltage (Supplied Externally)	VPP	22±3°C, 55±15%R.H	8.5	9	9.5	V
OLED Driver Supply Voltage (Generated by Internal DC/DC)	VPP	22±3°C, 55±15%R.H	-	9	-	V
High-level Input Voltage	V _{IH}	-	0.8 × VDD	-	VDD	V
Low-level Input Voltage	V _{IL}	-	VSS	-	0.2 × VDD	V
High-level Output Voltage	V _{OH}	-	0.8 × VDD	-	VDD	V
Low-level Output Voltage	V _{OL}	-	VSS	-	0.2 × VDD	V

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

8.2 Electro-optical Characteristics

ITEM	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Normal Mode Brightness	L_{br}	All pixels ON(1)	120	150	-	cd/m ²
ICC,Sleep mode Current consumption in VDD & VDD2	ICC,SLEEP	During sleep, TA = +25°C, VDD = 3V, VDD2 = 3.0V.	-	-	10	uA
IDD,Sleep mode Current consumption in VPP	IDD,SLEEP	During sleep, TA = +25°C, VPP = 9V (External)	-	-	10	uA
Normal Mode Power Consumption (VPP Generated by Internal DC/DC)	Pt=(IBAT*VDD2)	All pixels ON(1)	-	44.4	61.05	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	-	≥2000:1	-	-	-
Response Time	-	-	---	10	-	μ s
View Angle	-	-	≥160	-	-	Degree

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

- Driving voltage : 9.0V (VPP Supplied Externally) or VDD2:3.7V(VPP Generated by Internal DC/DC).
- Contrast setting : 0X25
- Frame rate : 105Hz
- Duty setting : 1/40

8.3 AC Electrical Characteristics

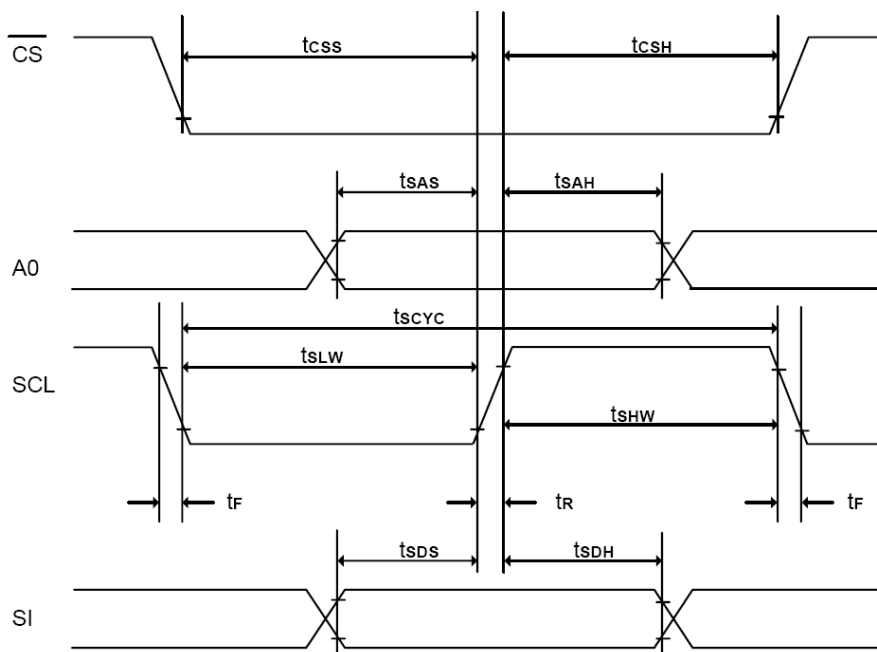
System buses Write characteristics 3 (For 4 wire SPI)

(VDD - VSS = 1.65V to 3.5V, TA = 25°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tscyc	Serial clock cycle	500	-	-	ns	
tsAS	Address setup time	300	-	-	ns	
tSAH	Address hold time	300	-	-	ns	
tsDS	Data setup time	200	-	-	ns	
tsDH	Data hold time	200	-	-	ns	
tcSS	$\overline{\text{CS}}$ setup time	240	-	-	ns	
tCSH	$\overline{\text{CS}}$ hold time time	120	-	-	ns	
tSHW	Serial clock H pulse width	200	-	-	ns	
tsLW	Serial clock L pulse width	200	-	-	ns	
tR	Rise time	-	-	30	ns	
tF	Fall time	-	-	30	ns	

(VDD - VSS = 2.4V to 3.5V, TA = 25°C)

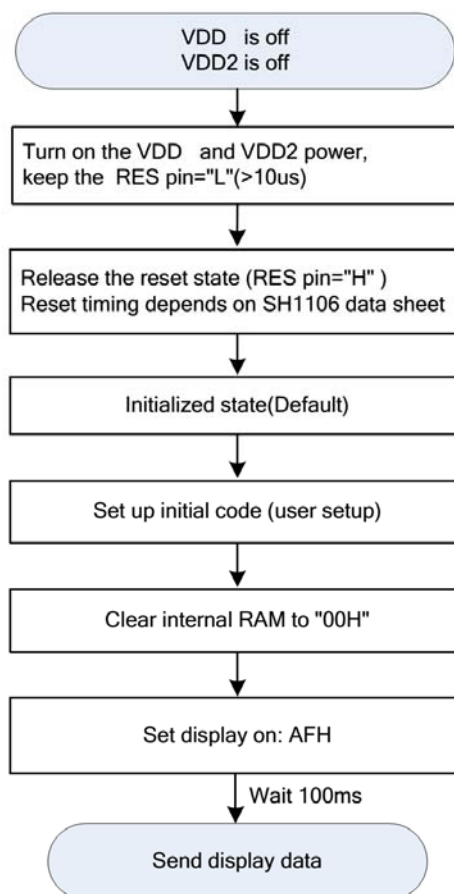
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tscyc	Serial clock cycle	250	-	-	ns	
tsAS	Address setup time	150	-	-	ns	
tSAH	Address hold time	150	-	-	ns	
tsDS	Data setup time	100	-	-	ns	
tsDH	Data hold time	100	-	-	ns	
tcSS	$\overline{\text{CS}}$ setup time	120	-	-	ns	
tCSH	$\overline{\text{CS}}$ hold time time	60	-	-	ns	
tSHW	Serial clock H pulse width	100	-	-	ns	
tsLW	Serial clock L pulse width	100	-	-	ns	
tR	Rise time	-	-	15	ns	
tF	Fall time	-	-	15	ns	



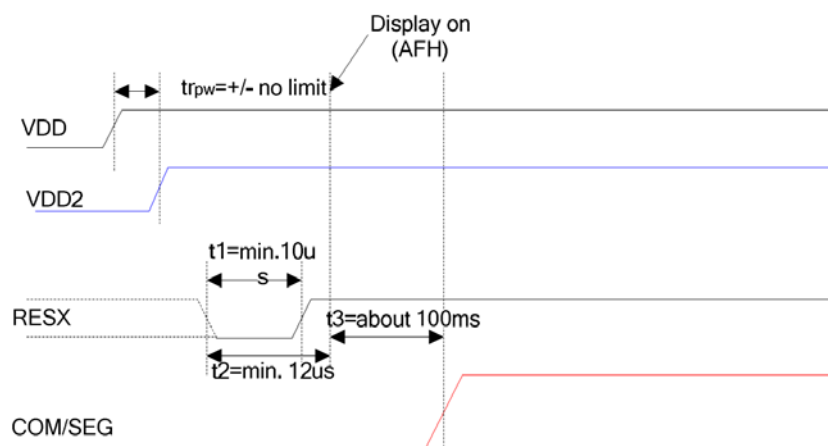
9 Functional Specification and Application Circuit

9.1 Power ON and Power OFF Sequence

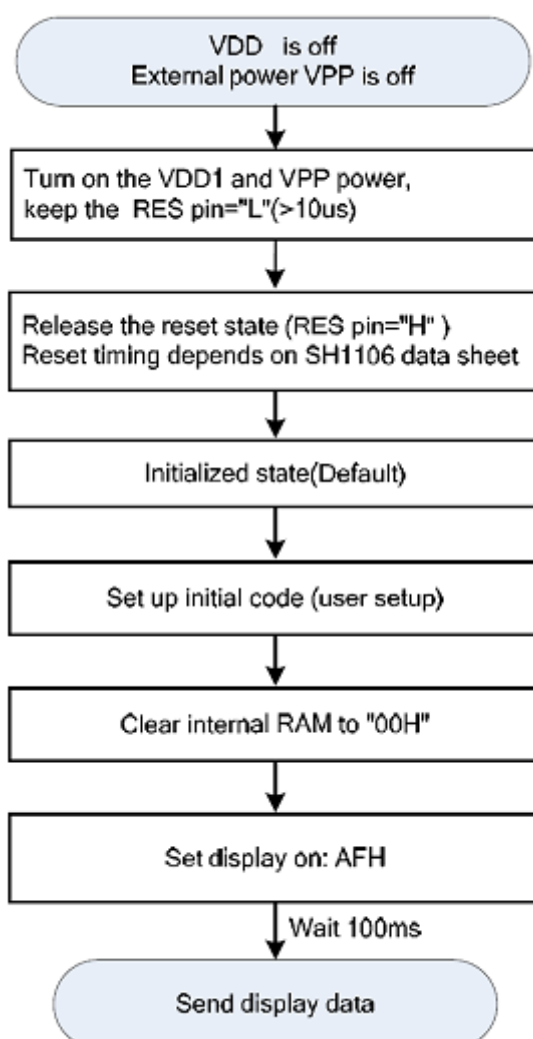
9.1.1 Built-in DC-DC pump power is being used immediately after turning on the power:



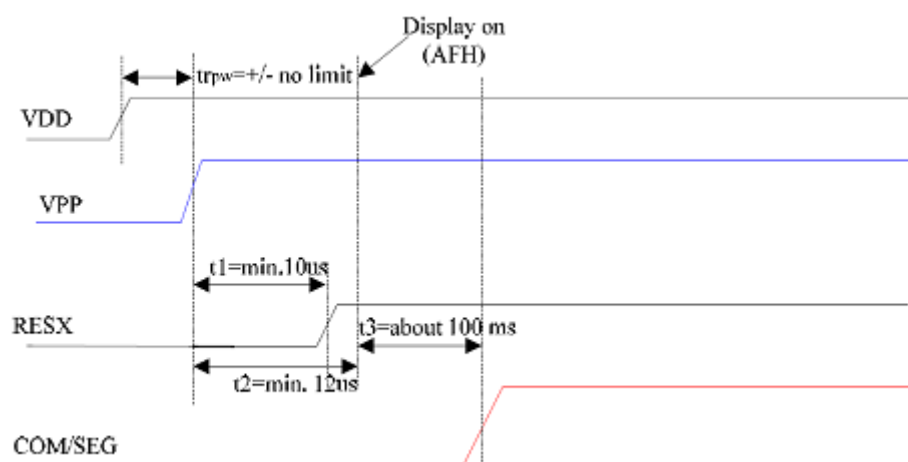
Power ON Sequence:



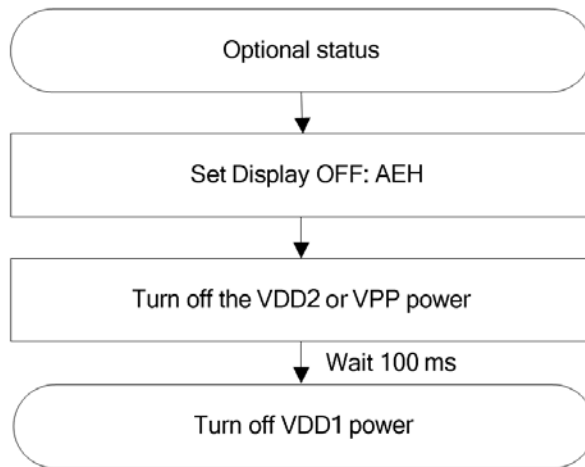
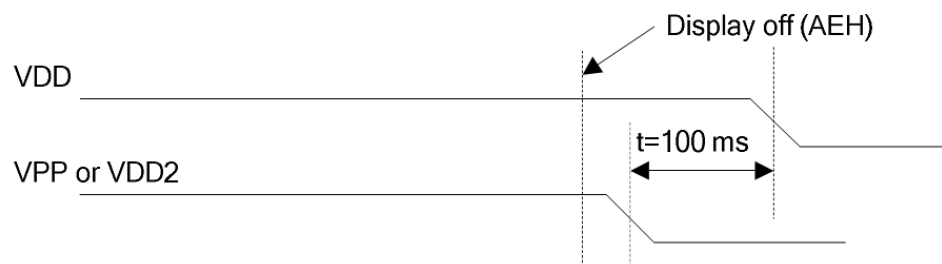
9.1.2 External power is being used immediately after turning on the power:



Power ON Sequence:

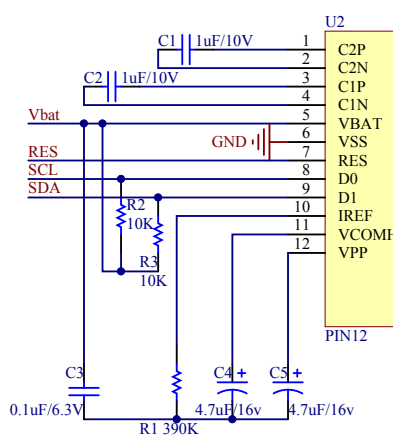


9.1.3 Power OFF

**Power OFF Sequence:**

9.2.2) Application Circuit

I2C接口原理图



- 说明
- 1、IIC Address:0x78
 - 2、信号脚的高电平需与VBAT一致;
 - 3、VBAT脚电压范围为3V-3.3V;

Pin connected to MCU interface: SCL, SDA, RES#

Under Internal DC/DC Mode, the Charge Pump Setting(8Dh) must be set as follow:

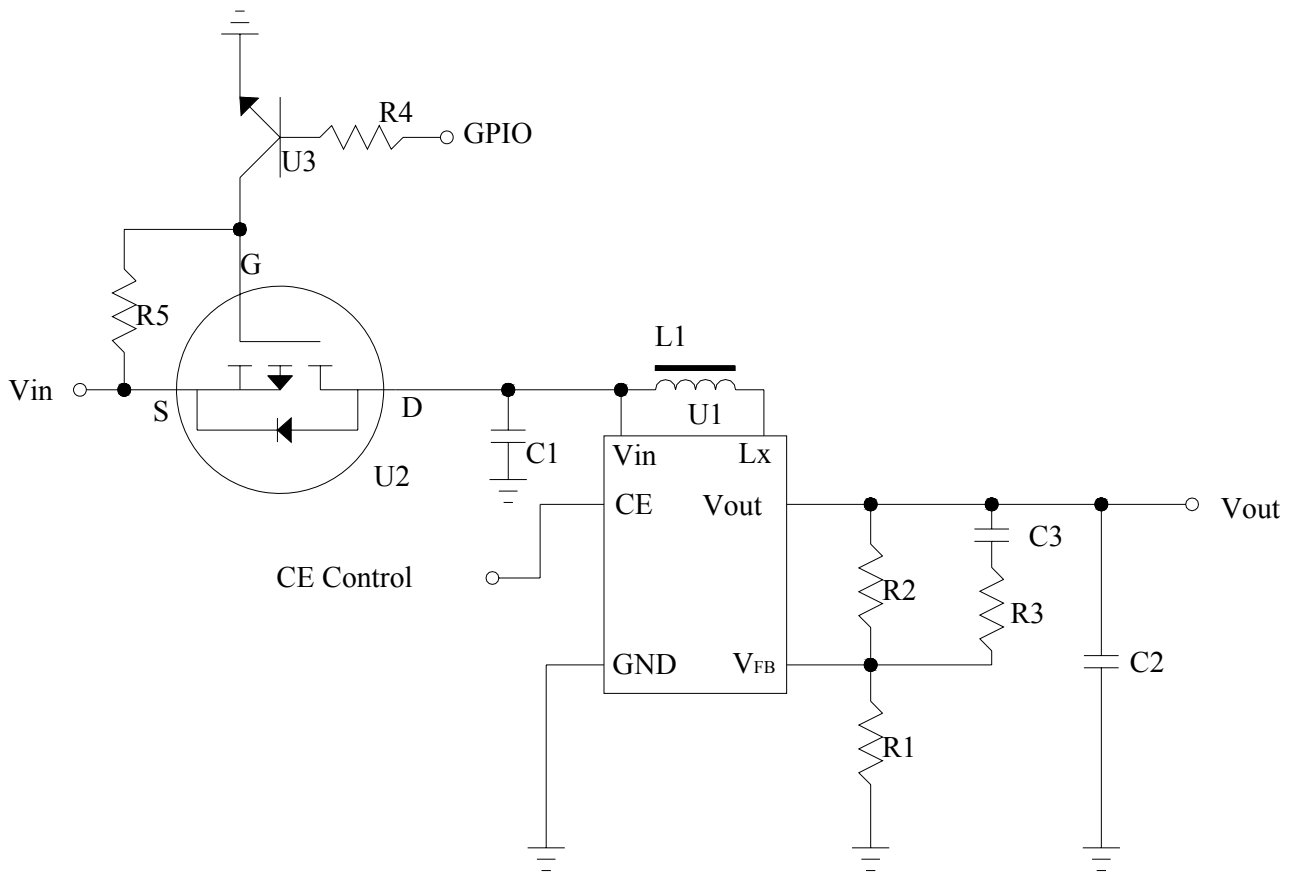
ADh: Charge Pump Setting

8Bh; Enable Charge Pump at 9V mode

I²C Address: 0x78

2) Application Example with External VPP

9.3 External DC-DC application circuit



Recommend component

The C1	: 1 uF-0603-X7R±10%.RoHS
The C2	: 1 uF-0603-X7R±10%.RoHS
The C3	: 220pF-0603-X7R±10%.RoHS
The R1	: 0603 1/10W +/-5% 10Kohm.RoHS
The R2	: 0603 1/10W +/-5% 80Kohm.RoHS
The R3	: 0603 1/10W +/-5% 2Kohm.RoHS
The R4	: 0603 1/10W +/-5% 1Kohm.RoHS
The R5	: 0603 1/10W +/-5% 10Kohm.RoHS
The L1	: 22uH
The U1	: R1200
The U2	: FDN338P
The U3	: 8050

9.4 Display Control Instruction

Refer to SH1106 IC Specification.

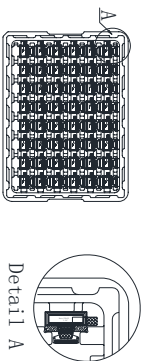
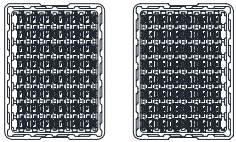
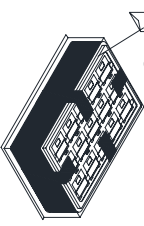
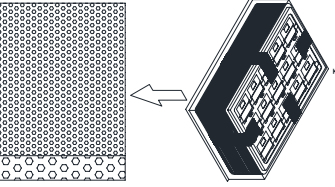
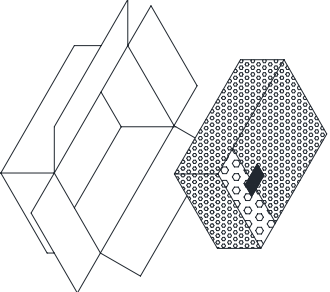
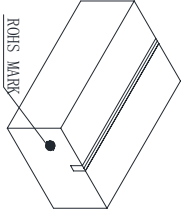
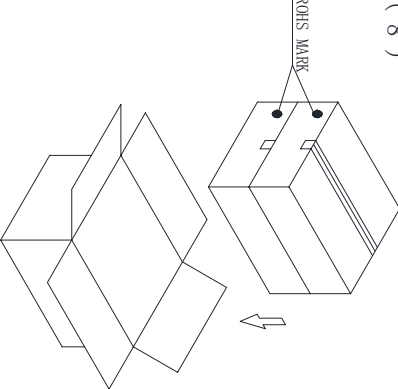
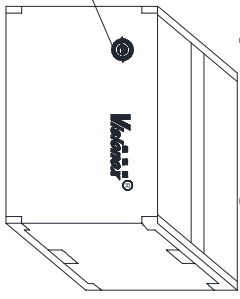
9.5 Recommended Software Initialization

In order to ensure the reliability and stability of the module, the module must initialize use the following code, Malfunctioning of the module may occur and the reliability of the module may deteriorate if the module is used beyond the initialize code.

```
void Init_IC()
{
    Write_Command(0xAE);    //Set Display Off
    Write_Command(0xD5);    //Display divide ratio/osc. freq. mode
    Write_Command(0x80);
    Write_Command(0xA8);    //Multiplex ration mode:63
    Write_Command(0x27);
    Write_Command(0xD3);    //Set Display Offset
    Write_Command(0x0C);
    Write_Command(0x40);    //Set Display Start Line
    Write_Command(0xAD);    //DC-DC Control Mode Set
    Write_Command(0x8B);    //DC-DC ON/OFF Mode Set
    Write_Command(0x33);    //Set Pump voltage value
    Write_Command(0xA1);    //Segment Remap
    Write_Command(0xC8);    //Set COM Output Scan Direction
    Write_Command(0xDA);    //Common pads hardware: alternative
    Write_Command(0x12);
    Write_Command(0x81);    //Contrast control
    Write_Command(0x25);
    Write_Command(0xD9);    //Set pre-charge period
    Write_Command(0x22);
    Write_Command(0xDB);    //VCOM deselect level mode
    Write_Command(0x28);
    Write_Command(0xA4);    //Set Entire Display On/Off
    Write_Command(0xA6);    //Set Normal Display
    Clear_Screen();
    Write_Command(0xAF);    //Set Display On
}
```


Controlled Seal

Packing Process (1) ~ (9)

(1) Tray Type:01921-MT6-A 	(2)  normal ① 180° revers ②	(3) order ①、②、①、② fix trays with tape 2112 pcs of 1 small carton 1 tray contain 96 pcs 22 contained trays, 1 empty tray 	(4) Use vacuum bag to package the tray and add 5 bags of desiccant into the vacuum bag *5 
(5) After tray be packaged, wrap the package in a bubble bag and seal with scotch tape. 	(6) 	(7) small carton package L390*W290*L120 mm 	(8) 
(9) M4 contained trays, 2 empty trays, Package quantity products: 4224 pcs of 1 big carton  Package finished L410*W310*L272 mm	NOTE:1、The inner carton and master carton must be sealed with adhesive tape. 2、Fill up the gap with tray. 3、If the customer has special needs with the RoHS making, the inner carton and master carton need adhesive new RoHS marking at .		

10 Package Specification

11 Reliability

11.1 Reliability Test

NO.	ITEM	CONDITION	QUANTITY
1	High Temperature (Non-operation)	85°C,240hrs	4
2	Low Temperature (Non-operation)	-40°C,240hrs	4
3	High Temperature (Operation)	70°C,240hrs	4
4	Low Temperature (Operation)	-40°C,240hrs	4
5	High Temperature / High Humidity (Operation)	60°C,90%RH,240hrs	4
6	Thermal shock (Non-operation)	-40°C~85°C (-40°C/30min;transit/3min;85°C/30min;transit/3min) 1cycle: 66min,30cycles	4
7	ESD (Non-operation)	Air discharge model :+/- 8kV Test nine dots and each dots should be discharged ten times and the interval time can't be less than one second.	4
8	Vibration	Frequency: 5~50Hz,0.5G Scan rate: 1 oct/min Time: 2 hrs/axis Test axis: X,Y, Z	1 Carton
9	Drop	Height: 100 cm Sequence: 1 angle, 3 edges and 6 faces	1 Carton

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 $\pm 3^{\circ}\text{C}$, and the tolerance of relative humidity is $\pm 5\%$.

Evaluation criteria

1. The function test is OK.
2. No observable defects.
3. Luminance: $\geq 50\%$ of initial value.
4. Current consumption: within $\pm 50\%$ of initial value.

11.2 Lifetime

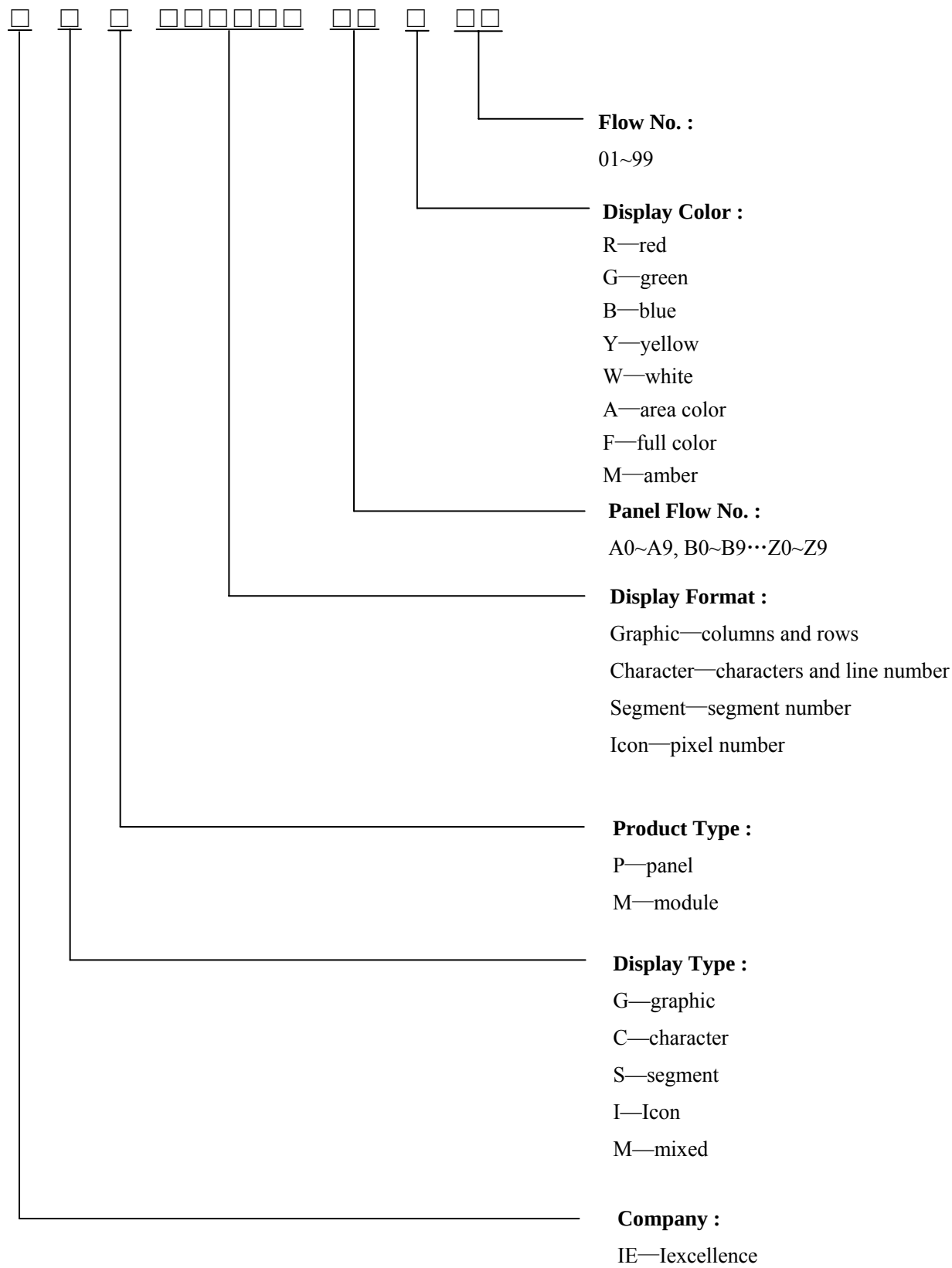
End of lifetime is specified as 50% of initial brightness and the test pattern at operating condition is 50% alternating checkerboard.

ITEM	MIN	MAX	UNIT	CONDITION
Operation Life Time	10,000	-	hrs	150 cd/m ² , 50% alternating checkerboard, 22 $\pm$ 3°C, 55 $\pm$ 15% RH

11.3 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 $\pm$ 3°C; 55 $\pm$ 15% RH.

12 Illustration of OLED Product Name



13 Outgoing Quality Control Specifications

13.1 Sampling Method

- (1) GB/T 2828.1ISO2859-1, inspection level II , normal inspection, single sample inspection
- (2) AQL: Major 0.65; Minor 1.0

13.2 Inspection Conditions

The environmental conditions for test and measurement are performed as follows.

Temperature: $22\pm 3^{\circ}\text{C}$

Humidity: $55\pm 15\%\text{R.H}$

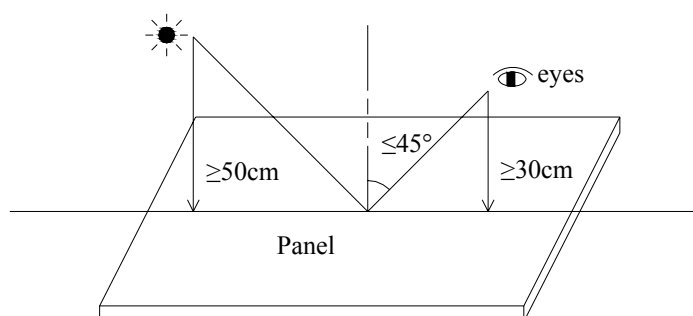
Fluorescent Lamp: 30W

Distance between the Panel & Lamp: $\geq 50\text{cm}$

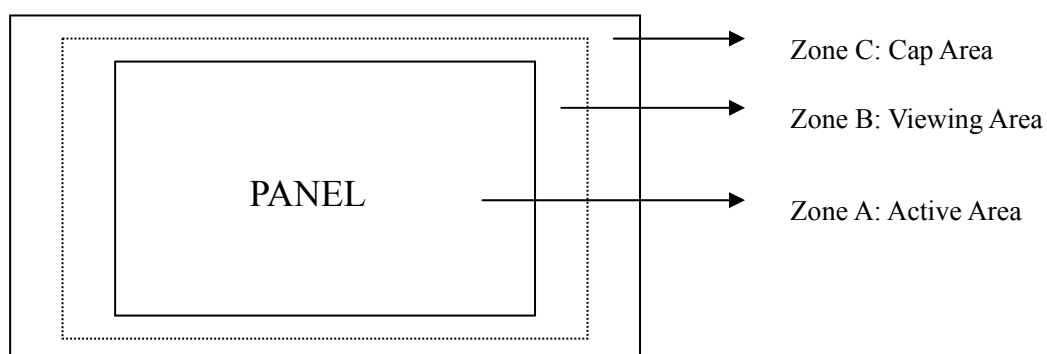
Distance between the Panel & Eyes: $\geq 30\text{cm}$

Viewing angle from the vertical in each direction: $\leq 45^{\circ}$

(See the sketch below)

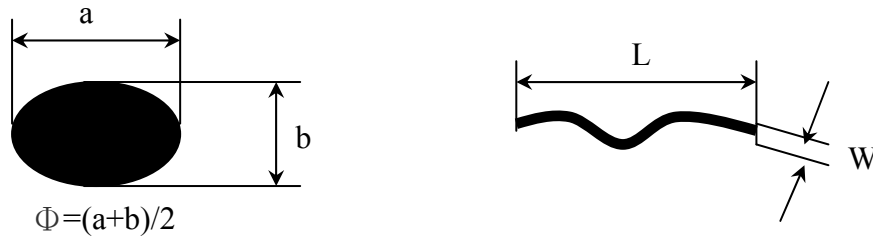


13.3 Quality Assurance Zones



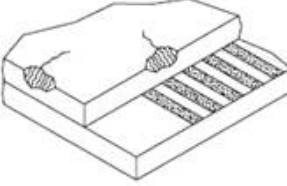
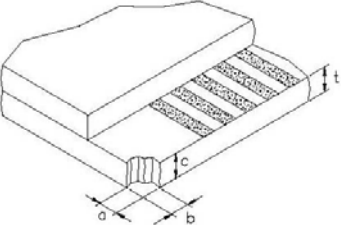
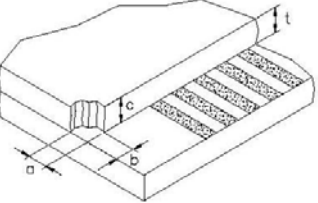
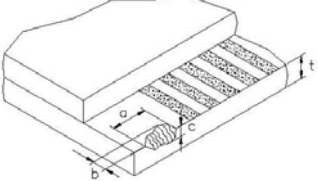
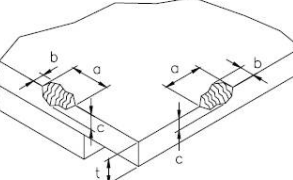
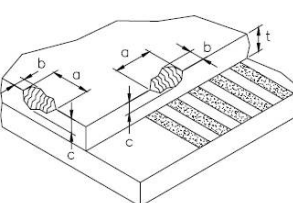
13.4 Inspection Standard

Definition of Φ &L&W (Unit: mm)



I . Appearance Defects

NO.	ITEM	CRITERIA			CLASSIFICATION																
1	Polarizer Black or White spot, Dirty spot, Foreign matter, Dent on the polarizer	<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>$\Phi \leq 0.15$</td><td>Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.15 < \Phi \leq 0.30$</td><td>3</td></tr><tr><td>$\Phi > 0.30$</td><td>0</td></tr></table>			Average Diameter (mm)	Acceptable Number		Zone A,B	Zone C	$\Phi \leq 0.15$	Ignore	Ignore	$0.15 < \Phi \leq 0.30$	3	$\Phi > 0.30$	0	Minor				
Average Diameter (mm)	Acceptable Number																				
	Zone A,B	Zone C																			
$\Phi \leq 0.15$	Ignore	Ignore																			
$0.15 < \Phi \leq 0.30$	3																				
$\Phi > 0.30$	0																				
2	Scratch/line on the glass/Polarizer	<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>$W \leq 0.03$</td><td>---</td><td>Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.03 < W \leq 0.08$</td><td>$L \leq 5.0$</td><td>3</td></tr><tr><td>$W > 0.08$</td><td>---</td><td>0</td></tr></table>			Width (mm)	Length (mm)	Acceptable Number		Zone A,B	Zone C	$W \leq 0.03$	---	Ignore	Ignore	$0.03 < W \leq 0.08$	$L \leq 5.0$	3	$W > 0.08$	---	0	Minor
Width (mm)	Length (mm)	Acceptable Number																			
		Zone A,B	Zone C																		
$W \leq 0.03$	---	Ignore	Ignore																		
$0.03 < W \leq 0.08$	$L \leq 5.0$	3																			
$W > 0.08$	---	0																			
3	Polarizer Bubble	<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>$\Phi > 0.5$</td><td>0</td><td rowspan="3">Ignore</td></tr><tr><td>$0.2 < \Phi \leq 0.5$</td><td>3</td></tr><tr><td>$\Phi \leq 0.2$</td><td>Ignore</td></tr></table>			Average Diameter (mm)	Acceptable Number		Zone A,B	Zone C	$\Phi > 0.5$	0	Ignore	$0.2 < \Phi \leq 0.5$	3	$\Phi \leq 0.2$	Ignore	Minor				
Average Diameter (mm)	Acceptable Number																				
	Zone A,B	Zone C																			
$\Phi > 0.5$	0	Ignore																			
$0.2 < \Phi \leq 0.5$	3																				
$\Phi \leq 0.2$	Ignore																				
4	Any Dirt & Scratch on Polarizer’s Protective Film	Ignore for not affect the polarizer.			Minor																
5	Any Dirt on Cap Glass	<table><tr><td>Average Diameter (mm)</td><td>Acceptable Number</td></tr><tr><td>$\Phi \leq 0.5$</td><td>Ignore</td></tr><tr><td>$0.5 < \Phi \leq 1.0$</td><td>3</td></tr><tr><td>$\Phi > 1.0$</td><td>0</td></tr></table>			Average Diameter (mm)	Acceptable Number	$\Phi \leq 0.5$	Ignore	$0.5 < \Phi \leq 1.0$	3	$\Phi > 1.0$	0	Minor								
Average Diameter (mm)	Acceptable Number																				
$\Phi \leq 0.5$	Ignore																				
$0.5 < \Phi \leq 1.0$	3																				
$\Phi > 1.0$	0																				

6	Glass Crack	 Propagation crack is not acceptable.	Major
7	Corner Chip	 $t = \text{Glass thickness}$ Accept $a \leq 2.0\text{mm}$ or $b \leq 2.0\text{mm}$, $c \leq t$	Minor
8	Corner Chip on Cap Glass	 $t = \text{Glass thickness}$ Accept $a \leq 1.5\text{mm}$ or $b \leq 1.5\text{mm}$, $c \leq t$	Minor
9	Chip on Contact Pad	 $t = \text{Glass thickness}$ Accept $a \leq 3.0\text{mm}$ or $b \leq 0.8\text{mm}$, $c \leq t$ (on the contact pin) $a \leq 3.0\text{mm}$ or $b \leq 1.5\text{mm}$, $c \leq t$ (outside of the contact pin)	Minor
10	Chip on Face of Display	 $t = \text{Glass thickness}$ Accept $a \leq 1.5\text{mm}$ or $b \leq 1.5\text{mm}$, $c \leq t$	Minor
11	Chip on Cap Glass	 $t = \text{Glass thickness}$ Accept $a \leq 3.0\text{mm}$ or $b \leq 3.0\text{mm}$, $c \leq t/2$ $a \leq 1.5\text{mm}$ or $b \leq 1.5\text{mm}$, $t/2 \leq c \leq t$	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

NO.	ITEM	CRITERIA			CLASSIFICATION
1	Black/White spot Dirty spot Foreign matter	Average Diameter (mm)	Pieces Permitted		Minor
			Zone A,B	Zone C	
		$\Phi\leq0.10$	Ignore	Ignore	
		$0.10<\Phi\leq0.20$	3		
		$\Phi>0.20$	0		
2	No Display	Not allowable.			Major
3	Irregular Display	Not allowable.			Major
4	Missing Line (row or column)	Not allowable.			Major
5	Short	Not allowable.			Major
6	Flicker	Not allowable.			Major
7	Abnormal Color	Refer to the SPEC.			Major
8	Luminance NG	Refer to the SPEC.			Major
9	Over Current	Refer to the SPEC.			Major

14 Precautions for operation and Storage

14.1 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.

14.2 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°C, but we suggest that during soldering, the temperature of iron tip should be no higher than 330°C and soldering be finished within 3~4 seconds.

14.3 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°C and 35°C and the relative humidity less than 60%. 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.

14.4 Warranty period

Excellent warrants for a period of 12 months from the shipping date when stored or used under normal condition.