

Product Specification

Product Name: TSO128128-A01

Product Code:

Customer
Approved by Customer
Approved Date:

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REV.	REVISION DESCRIPTION	REV. DATE	REMARK
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[illegible]

1 Overview

VGM128128B0W07 is a monochrome OLED display module with 128×128 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.

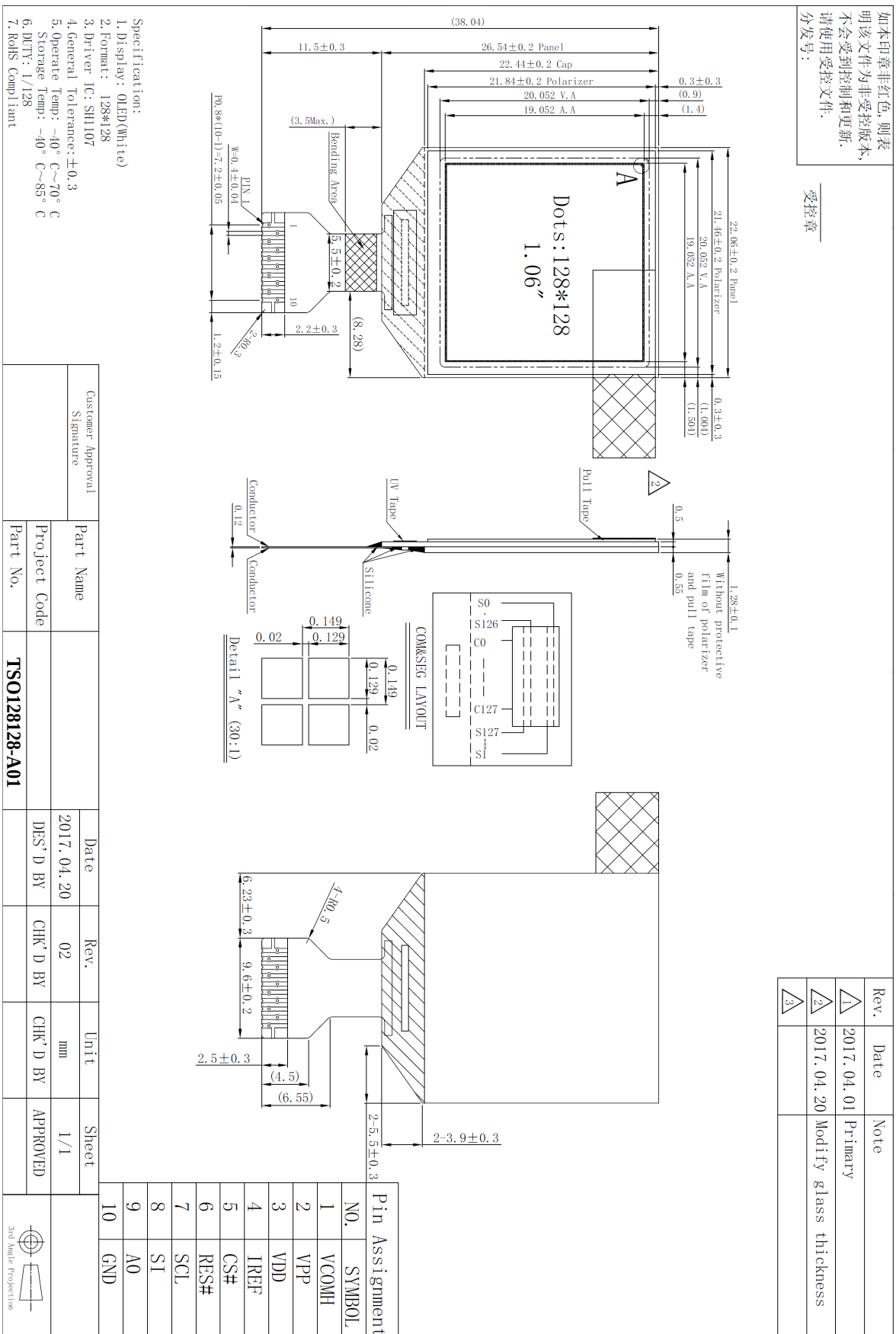
2 Features

- Display Color: White
- Dot Matrix: 128×128
- Driver IC: SH1107
- Interface: 4-wire SPI
- Wide range of operating temperature: -40℃ to 70℃

3 Mechanical Data

NO.	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	128(W)×128(H)	-
2	Dot Size	0.129(W)×0.129(H)	mm ²
3	Dot Pitch	0.149(W)×0.149(H)	mm ²
4	Aperture Rate	75	%
5	Active Area	19.052(W)×19.052(H)	mm ²
6	Panel Size	22.06(W) ×26.54(H) × 1.05(T)	mm ³
7	Module Size	22.06(W) ×38.04(H) × 1.28(T)	mm ³
8	Diagonal A/A Size	1.06	inch
9	Module Weight	1.09±10%	gram

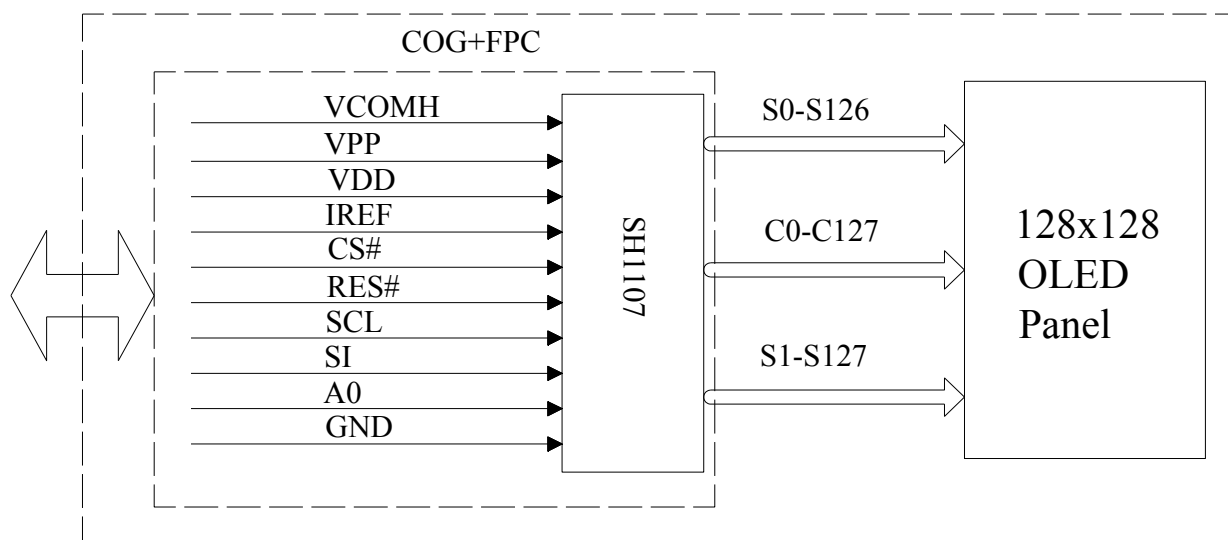
4 Mechanical Drawing



5 Module Interface

PIN NO.	PIN NAME	DESCRIPTION
1	VCOMH	COM signal deselected voltage level. A capacitor should be connected between this pin and VSS. No external power supply is allowed to connect to this pin.
2	VPP	Power supply for panel driving voltage.
3	VDD	Power supply pin for core logic operation.
4	IREF	This pin is the segment output current reference pin. A resistor should be connected between this pin and VSS to maintain the current around 15.625uA.
5	CS#	This pin is the chip select input connecting to the MCU.
6	RES#	This pin is reset signal input.
7	SCL	The serial clock input pad.
8	SI	The serial data input pad.
9	A0	This pin is Data/Command control pin connecting to the MCU.
10	GND	Ground pin. It must be connected to external ground.

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
	VPP	-0.3	17.0	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 “GND = 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
Operating Voltage	VPP	-	11	12.5	13	V
Logic Supply Voltage	VDD	-	2.4	3.0	3.5	V
High-level Output voltage	V _{OHC}	I _{OH} =-0.5mA(SDA, SCL)	0.8×VDD	-	VDD	V
Low-level Output voltage	V _{OLC}	I _{OL} =0.5mA(SDA, SCL)	VSS	-	0.2×VDD	V
High Logic Input voltage	V _{IHC}	SDA, SCL and RES#.	0.8×VDD	-	VDD	V
Low Logic Input voltage	V _{ILC}		VSS	-	0.2×VDD	V

8.2 Electro-optical Characteristics

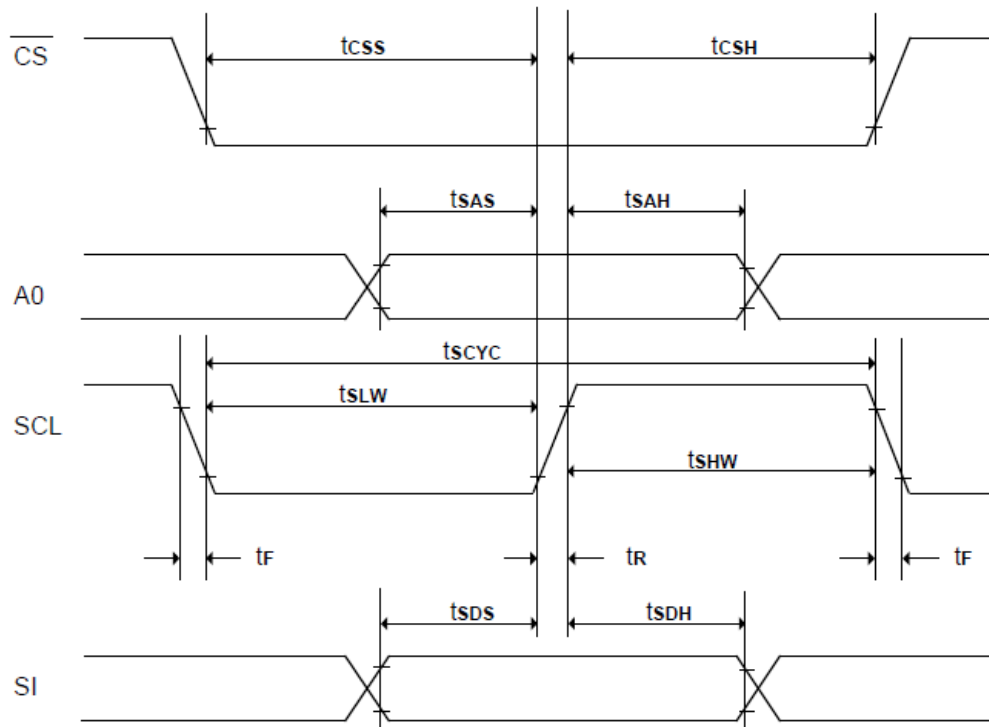
ITEM	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Normal Mode Brightness	L _{br}	All pixels ON(1)	200	220	-	cd/m ²
VDD Sleep mode Current	ISP_VDD	VDD=2.8V,VPP=OFF Display OFF, No panel attached	-	0.02	10	uA
VPP Sleep mode Current	ISP_VPP	VDD=2.8V,VPP=7-16.5V Display OFF, No panel attached	-	0.02	10	uA
Normal Mode Power Consumption	Pt	All pixels ON(1)	-	487.5	657.5	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 : 12.5
- Contrast setting : 0xFF
- Frame rate : 104Hz
- Duty setting : 1/128

8.3 AC Electrical Characteristics

System buses Write characteristics (For 4 wire SPI)



($V_{DD1} = 1.65 - 2.4V$, $T_A = +25^\circ C$)

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	$\overline{CS}$ setup time	240	-	-	ns	
tCSH	$\overline{CS}$ 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	

($V_{DD1} = 2.4 - 3.5V$, $T_A = +25^\circ C$)

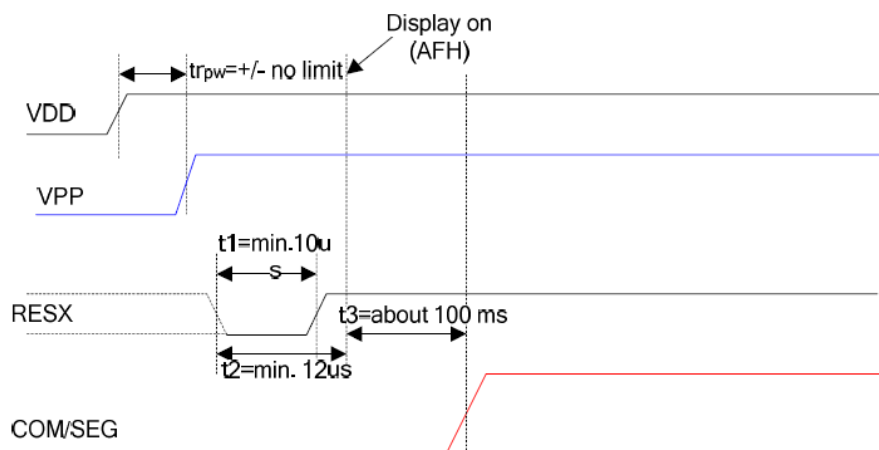
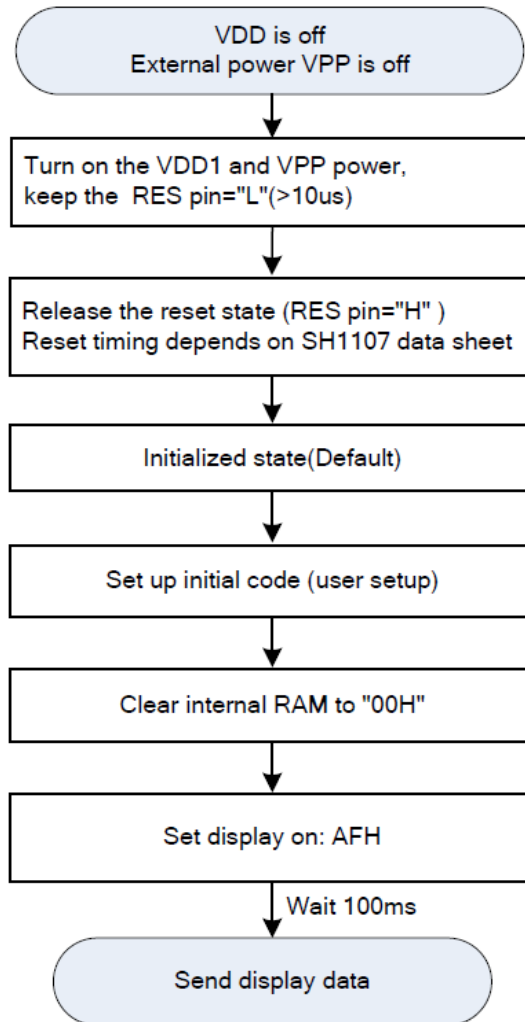
Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tSCYC	Serial clock cycle	250	-	-	ns	
tSAS	Address setup time	150	-	-	ns	
tSAH	Address hold time	150	-	-	ns	
tSDS	Data setup time	100	-	-	ns	
tSDH	Data hold time	100	-	-	ns	
tCSS	$\overline{CS}$ setup time	120	-	-	ns	
tCSH	$\overline{CS}$ hold time time	60	-	-	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	

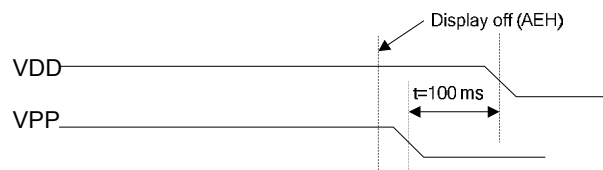
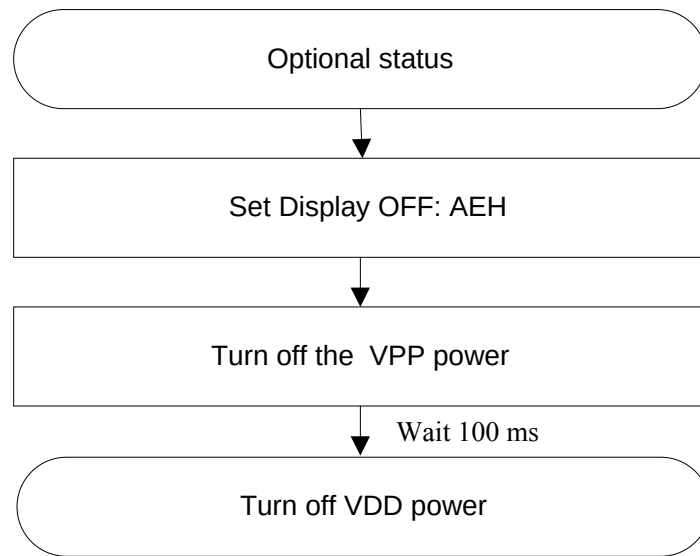
9 Functional Specification and Application Circuit

9.1 Power ON/OFF Sequence and Initialization

Power on sequence:

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

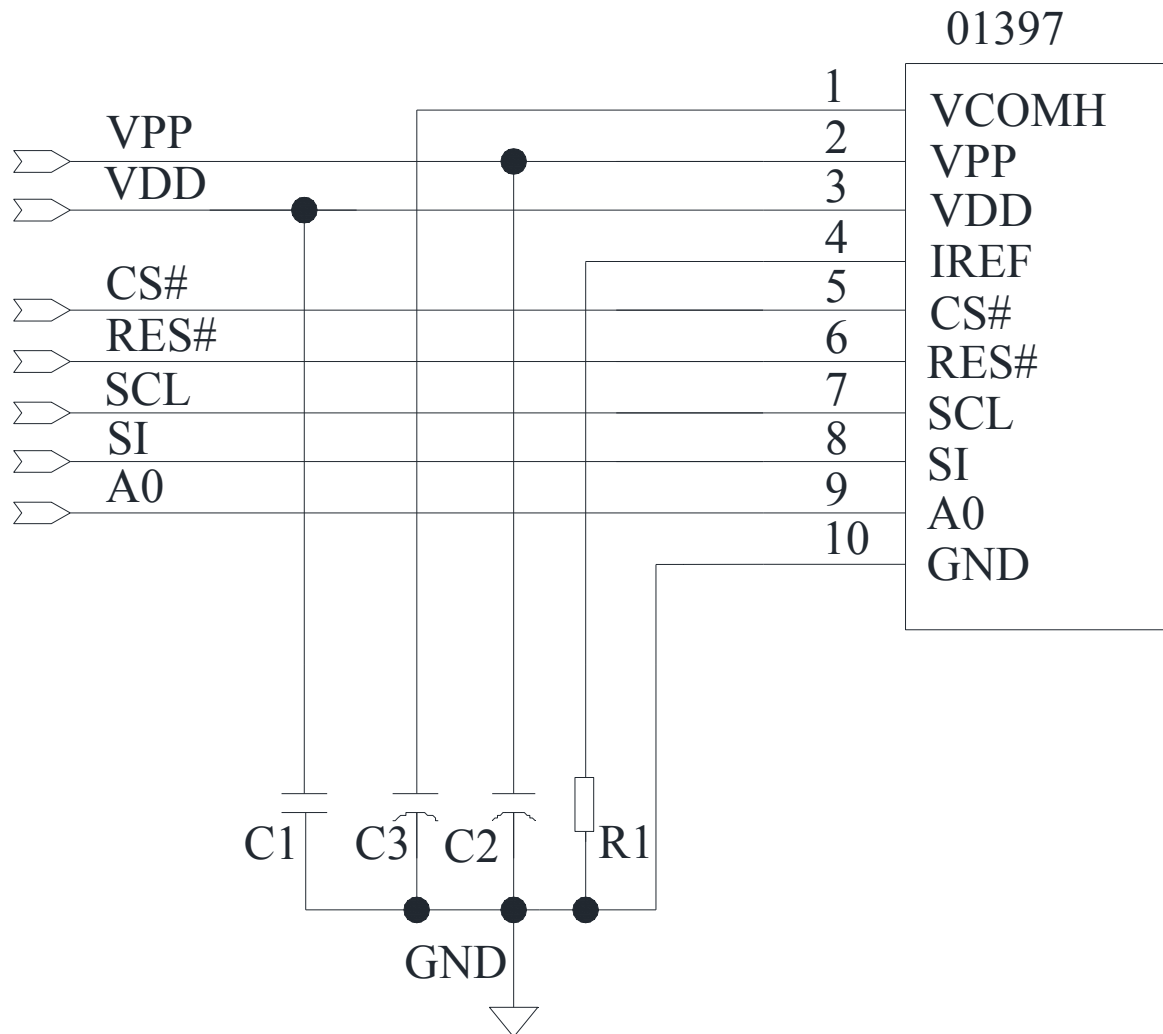


Power off sequence:

Note: There will be no damages to the display module if the power sequences are not met.

9.3 Application Circuit

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



Pin connected to MCU interface: SCL, SI,A0, CS#,RES#

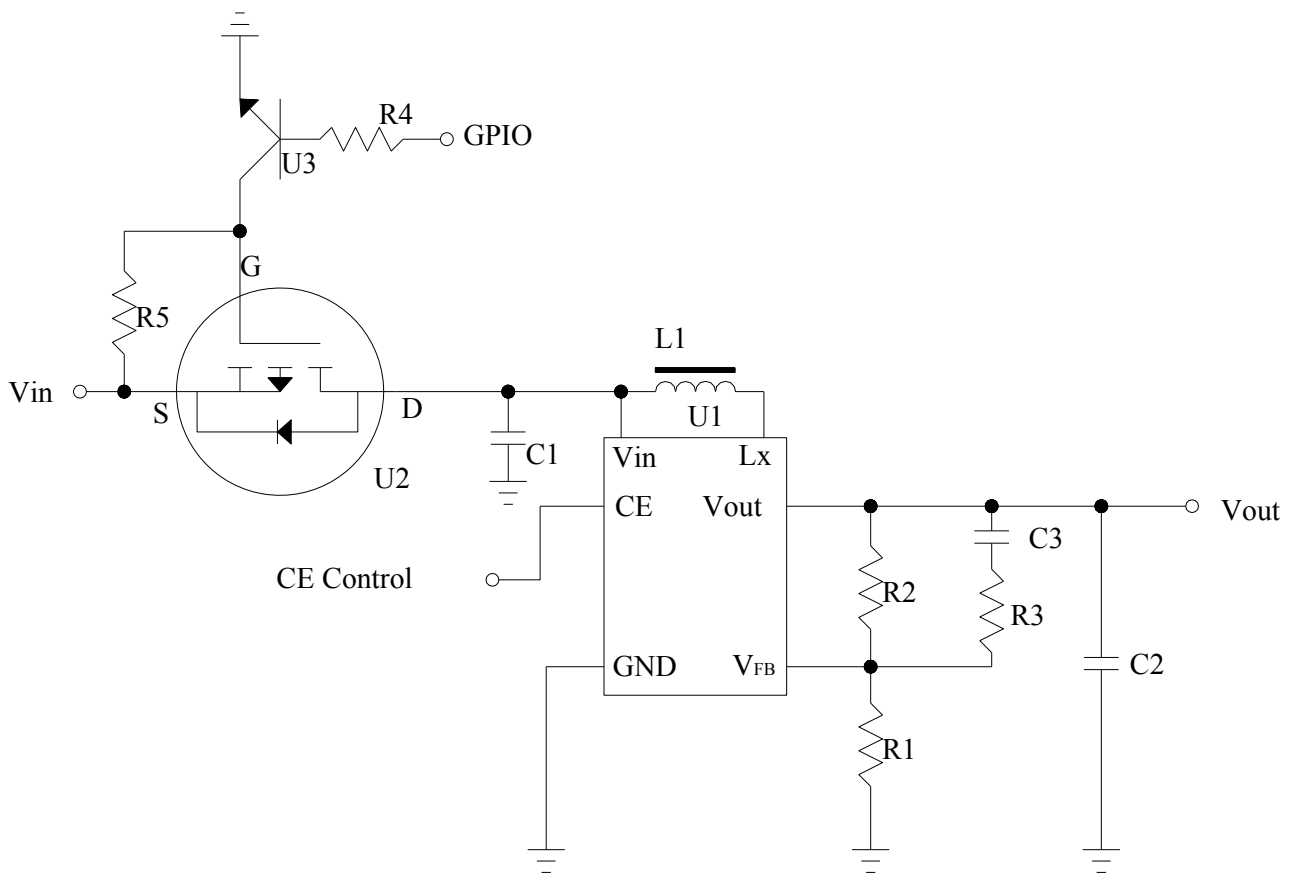
Recommended components

C1: 0.1uF-0603-X7R±10%.RoHS

C2, C3: 4.7μF/25V.RoHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 390K Mohm.RoHS

9.4 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% 115Kohm.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

9.5 Display Control Instruction

Refer to SH1107 IC Specification.

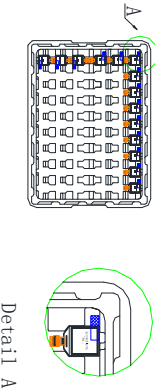
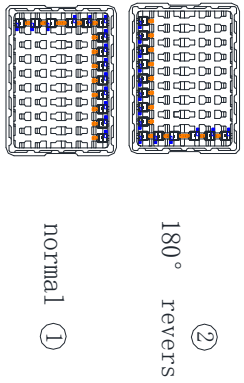
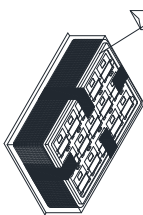
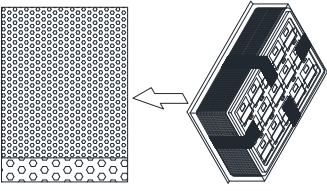
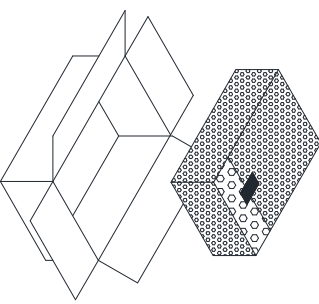
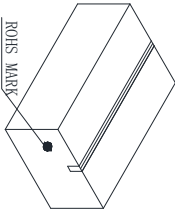
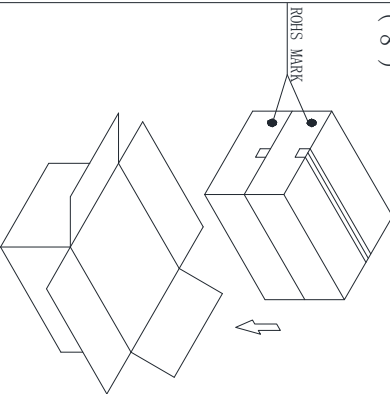
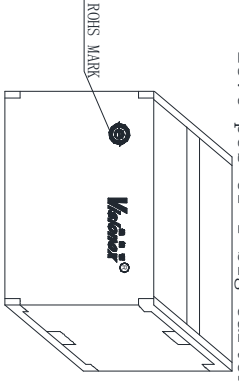
9.6 Recommended Software Initialization

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_program()
{
    write_c(0xae);    //Display OFF
    write_c(0xd5);    // Set Dclk
    write_c(0x50);    //104Hz
    write_c(0x20);    // Set row address
    write_c(0x81);    // Set contrast control
    write_c(0xff);
    write_c(0xa0);    // Segment remap
    write_c(0xa4);    // Set Entire Display ON
    write_c(0xa6);    // Normal display
    write_c(0xad);    // Set external VPP
    write_c(0x80);
    write_c(0xc0);    // Set Common scan direction
    write_c(0xd9);    // Set phase length
    write_c(0x22);
    write_c(0xdb);    // Set Vcomh voltage
    write_c(0x3a);
    Clear_screen();
    write_c(0xaf);    //Display ON
}
```

Controlled Seal

Packing Process(1)~(9)

(1) Tray Type: 01397-MT5-A Note: Display surface facing down 	(2) 	(3) order①、② ①、② fix trays with tape 1188 pcs of 1 small carton 1 tray contain 54 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) 44 contained trays, 2 empty trays, Package quantity products: 2376 pcs of 1 big carton 	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
7	Vibration	Frequency: 5~50Hz,0.5G Scan rate: 1 oct/min Time: 2 hrs/axis Test axis: X,Y, Z	1 Carton
8	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.

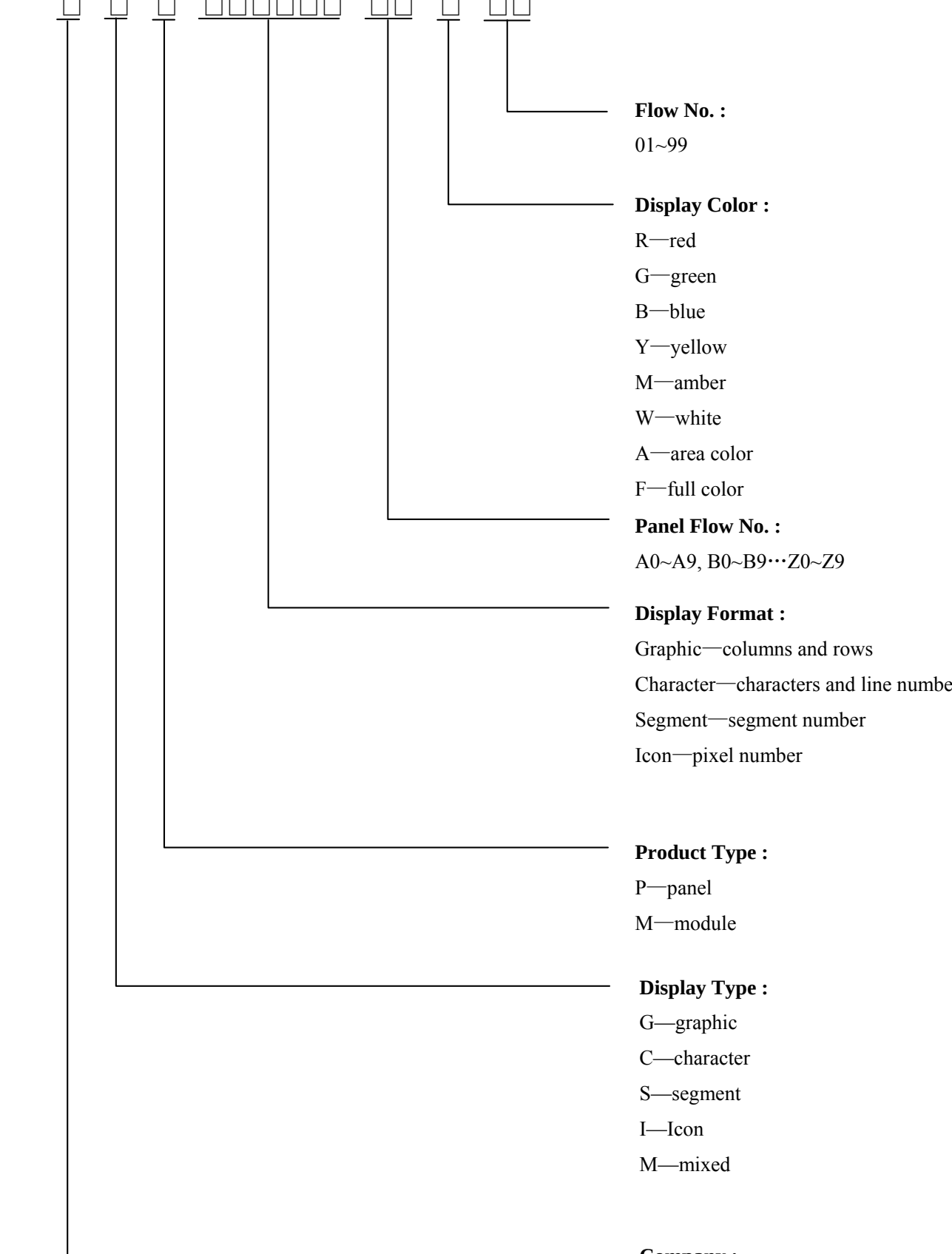
11.2 Lifetime

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	5000	-	hrs	220 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.



13 Outgoing Quality Control Specifications

13.1 Sampling Method

- (1) GB/T 2828.1/ISO2859-1: 1999, 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: $55 \pm 15\% \text{R.H}$

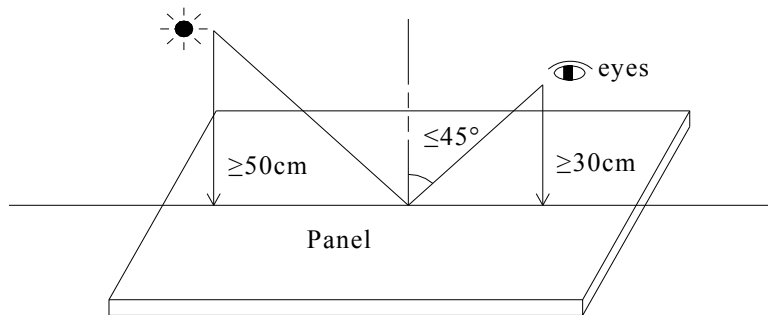
Fluorescent Lamp: 30W

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

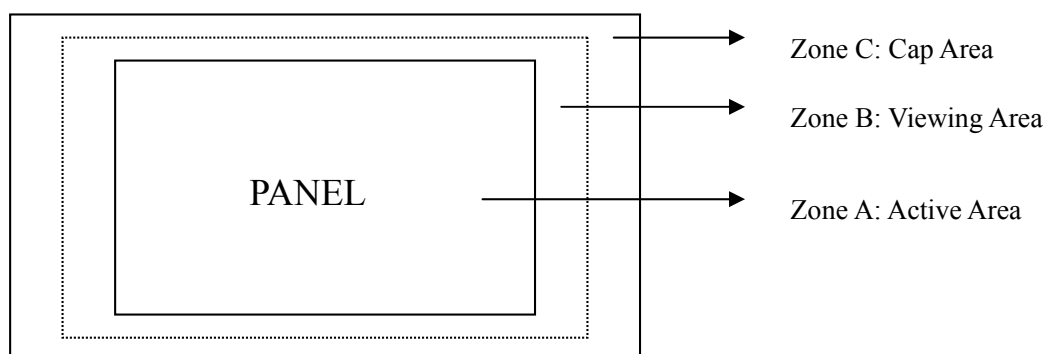
Distance between the Panel & Eyes: $\geq 30\text{cm}$

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

(See the sketch below)

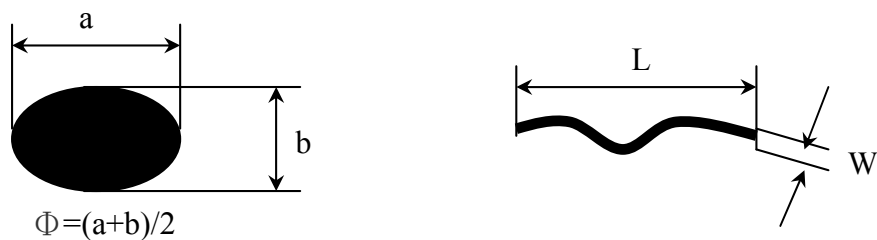


13.3 Quality Assurance Zones



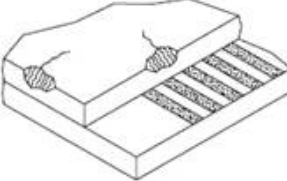
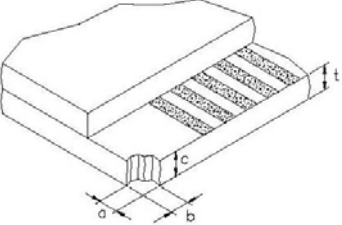
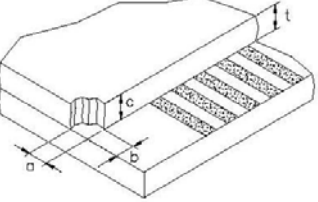
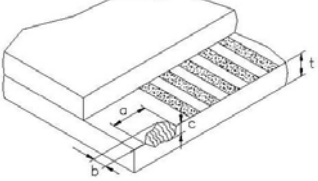
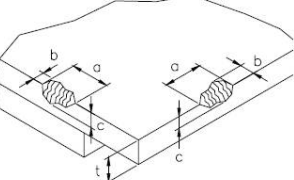
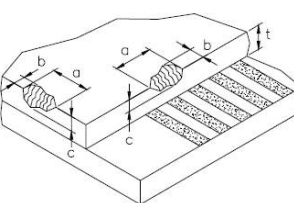
13.4 Inspection Standard

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="3">Acceptable Number</td></tr><tr><td>Zone A,B</td><td colspan="2">Zone C</td></tr><tr><td>$\Phi \leq 0.15$</td><td>Ignore</td><td colspan="2" 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="3">Acceptable Number</td></tr><tr><td>Zone A,B</td><td colspan="2">Zone C</td></tr><tr><td>$\Phi > 0.5$</td><td>0</td><td colspan="2" 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 colspan="3">Acceptable Number</td></tr><tr><td>$\Phi \leq 0.5$</td><td colspan="3">Ignore</td></tr><tr><td>$0.5 < \Phi \leq 1.0$</td><td colspan="3">3</td></tr><tr><td>$\Phi > 1.0$</td><td colspan="3">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 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.