Zeppelinstrasse 19 D-82205 Gilching Fon +49-8105-778090 info@lcd-module.de http://www.lcd-module.de

12.2024

OLED - 128x32 dots

Incl. controller SH1106

Features

- 2.22” Low-Power OLED
- -40..+80°C ($T_{op.}$)
- 128x32 dots yellow and white
- Incl. controller SH1106
- SPI, I²C, 8-Bit Interface
- Fast response time (10µs) even at -40°C
- ZIFF connection

Ordering code

OLED 2.22” - 128x32 dots, SH1106 yellow	**EA W128032-XBLG**
OLED 2.22” - 128x32 dots, SH1106 white	**EA W128032-XBLW**

Accessory

ZIFF connector 24 pins, 0.5mm pitch, top contact	**EA WF050-24T**
USB-Testboard	**EA 9781-2USB**

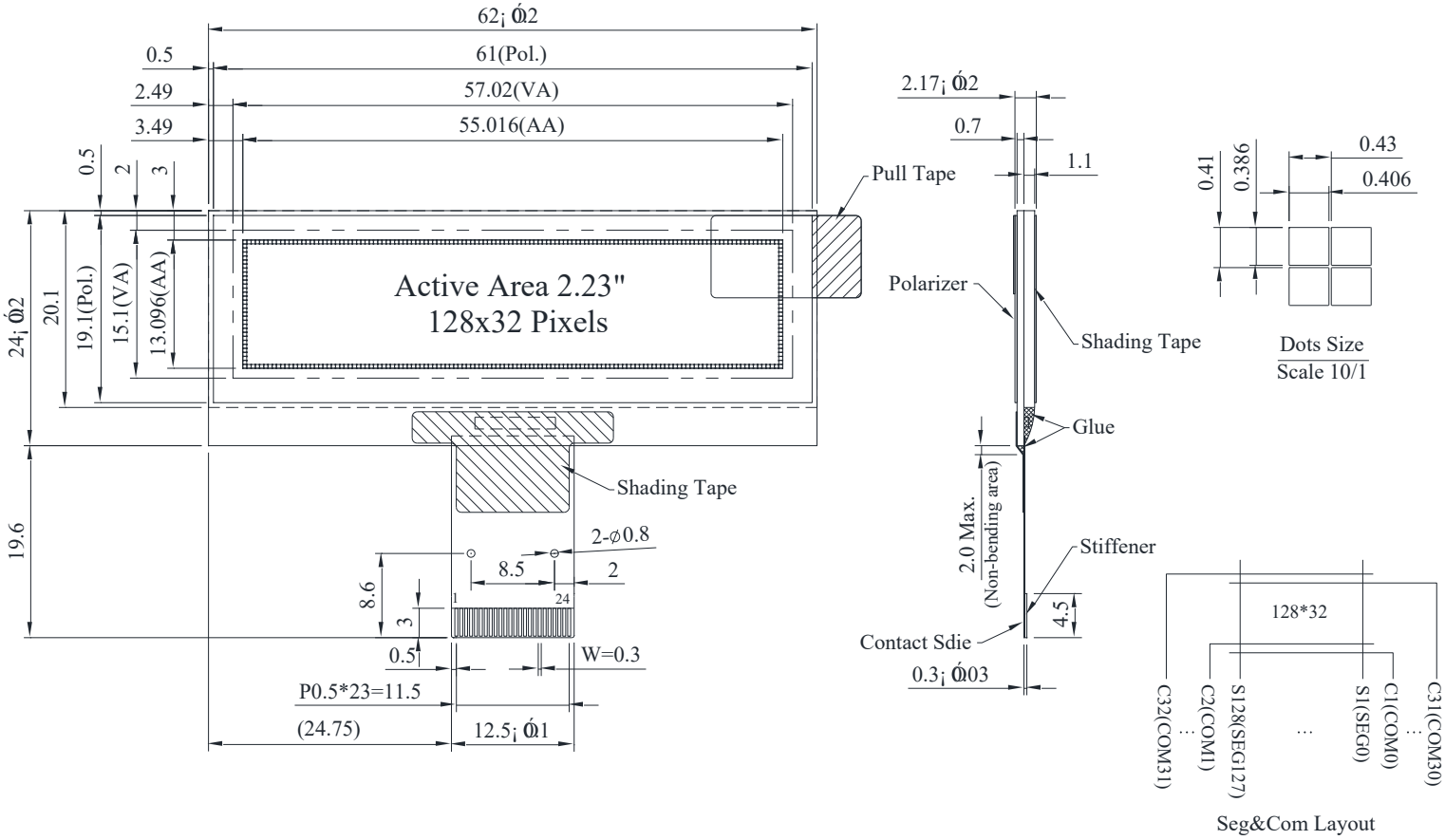
Content

1. General Specification

Item	Dimension	Unit
Dot Matrix	128 x 32 Dots	–
Module dimension	62.0 × 24.0 × 2.17	mm
Active Area	55.016 × 13.096	mm
Pixel Size	0.406 × 0.386	mm
Pixel Pitch	0.43 × 0.41	mm
Display Technology	OLED Passive Matrix	
Display Color	Yellow (EA W128032-XBLG) White (EA W128032-XBLW)	
Interface	6800, 8080, 4-Wire SPI, I2C	
IC	SH1106	

Zeppelinstrasse 19 D-82205 Gilching Fon +49-8105-778090 info@lcd-module.de http://www.lcd-module.de

2. Contour Drawing & Block Diagram



PIN	SYMBOL
1	NC(GND)
2	VSS
3	VSS
4	NC
5	VDD1
6	IM1
7	IM2
8	$\overline{CS}$
9	$\overline{RES}$
10	A0
11	$\overline{WR}$
12	E/$\overline{RD}$
13	D0
14	D1
15	D2
16	D3
17	D4
18	D5
19	D6
20	D7
21	IREF
22	VCOMH
23	VPP
24	NC(GND)

The non-specified tolerance of dimension is ¡ Ó3 mm .

3. Interface Pin Function

No.	Symbol	Function
1	N.C.(GND)	No connection
2	VSS	Ground.
3	VSS	Ground.
4	N.C.	No connection
5	VDD	Power supply pin for core logic operation
6	BS1	Communicating Protocol Select These pins are MCU interface selection input. See the following table:
7	BS2	

	68XX-parallel	80XX-parallel	Serial	I2C
BS1	0	1	0	1
BS2	1	1	0	0

8	$\overline{CS}$	This pad is the chip select input. When CSB = “L”, then the chip select becomes active, and data/command I/O is enabled.
9	$\overline{RES}$	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.
10	A0	This is the Data/Command control pad that determines whether the data bits are data or a command. A0 = “H”: the inputs at D0 to D7 are treated as display data. A0 = “L”: the inputs at D0 to D7 are transferred to the command registers. In I2C interface, this pad serves as SA0 to distinguish the different address of OLED driver.
11	$\overline{WR}$	This is a MPU interface input pad. When connected to an 8080 MPU, this is active LOW. This pad connects to the 8080 MPU WR signal. The signals on the data bus are latched at the rising edge of the WR signal. When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When R/W = “H”: Read. When R/W = “L”: Write.
12	E/$\overline{RD}$	This is a MPU interface input pad. When connected to an 8080 series MPU, it is active LOW. This pad is connected to the RD signal of the 8080 series MPU, and the data bus is in an output status when this signal is “L”. When connected to a 6800 series MPU , this is active HIGH. This is used as an enable clock input of the 6800 series MPU. When RD = “H”: Enable. When RD = “L”: Disable.
13..20	D0..D7	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected, then D0 serves as the serial clock input pad (SCL) and D1 serves as the serial data input pad (SI). At this time, D2 to D7 are set to high impedance. When the I2C interface is selected, then D0 serves as the serial clock input pad (SCL) and D1 serves as the serial data input pad (SDAI). At this time, D2 to D7 are set to high impedance.
21	IREF	This is a segment current reference pad. A resistor should be connected between this pad and VSS. Set the current at 18.75uA.
22	VCOMH	This is a pad for the voltage output high level for common signals. A capacitor should be connected between this pad and VSS.
23	VPP	OLED panel power supply. It could be supplied externally. A capacitor should be connected between this pad and VSS.
24	N.C.(GND)	No connection.

4. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	VDD	-0.3	3.6	V	1, 2
Supply Voltage for Display	VPP	-0.3	14.5	V	1, 2
Operating Temperature	T_{OP}	-40	+80	°C	-
Storage Temperature	T_{STG}	-40	+80	°C	-

Note :

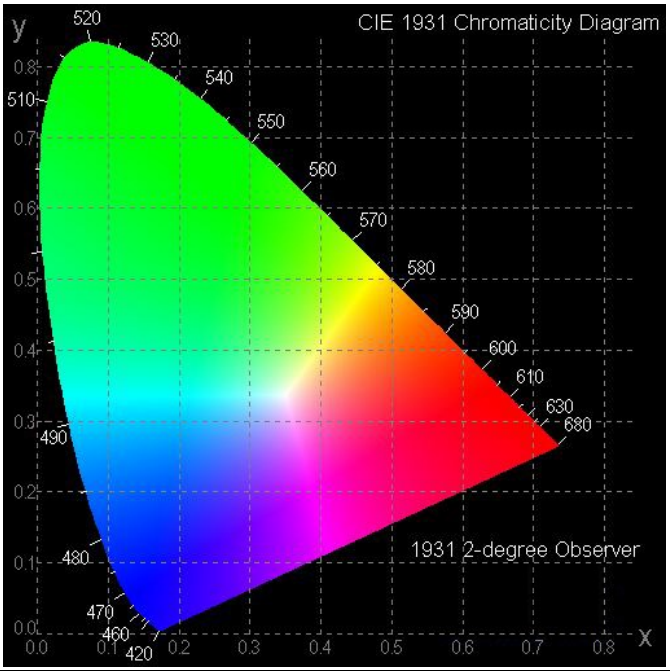
1. *All the above voltages are on the basis of "VSS = 0V".*
2. *When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also, for normal operations, it is desirable to use this module under the conditions according to Section "Electrical Characteristics". If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.*
3. *The absolute limit temperature was verified according to the test conditions of reliability test (See section "Reliability") , and module was met all criteria.*
4. *The defined temperature ranges do not include the polarizer. The maximum withstood temperature of the polarizer should be 80°C.*

5. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	VDD	–	1.65	3.0	3.3	V
Supply Voltage for Display	VPP	–	6.4	12.0	12.5	V
Input High Volt.	VIH	–	0.8XVDD1	–	VDD1	V
Input Low Volt.	VIL	–	VSS	–	0.2xVDD1	V
Output High Volt.	VOH	–	0.8xVDD1	–	VDD1	V
Output Low Volt.	VOL	–	VSS	–	0.2xVDD1	V
Display 50% Pixel On	IPP	VPP=12V	–	9	13.5	mA

6. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V)θ		160			deg
	(H)φ		160			deg
Contrast Ratio	CR	Dark	10,000:1		—	—
Response Time	T rise	—		10		µs
	T fall	—		10		µs
Brightness (50% check board)		yellow	100	150		cd/m²
		white	100	120		cd/m²
CIEx (-XBLG, yellow)		(CIE1931)	0.45	0.47	0.49	-
CIEy (-XBLG, yellow)		(CIE1931)	0.48	0.50	0.52	-
CIEx (-XBLW, white)		(CIE1931)	0.26	0.28	0.30	-
CIEy (-XBLW, white)		(CIE1931)	0.30	0.32	0.34	-



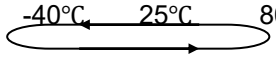
7. OLED Lifetime

ITEM		Conditions	Min	Typ	Remark
Operating Lifetime	-XBLG, yellow	Ta=25℃ / Initial 50% check board brightness Typical Value	50,000 hrs	-	Note
	-XBLW, white		20,000 hrs	-	Note

Note:
1. *Lifetime is defined the amount of time when the luminance has decayed to <50% of the minimal brightness.*
2. *This analysis method uses life data obtained under accelerated conditions to extrapolate an estimated probability density function (pdf) for the product under normal use conditions.*
3. *Screen saving mode will extend OLED lifetime.*
4. *Lifetime is not guaranteed one but expected lifetime in normal condition.*

8. Reliability

Content of Reliability Test

Environmental Test			
Test Item	**Content of Test**	**Test Condition**	**Applicable Standard**
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 240hrs	___
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-40℃ 240hrs	___
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	80℃ 240hrs	___
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-40℃ 240hrs	___
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60℃,90%RH 240hrs	___
Temperature Cycle	Endurance test applying the low and high temperature cycle.  30min 5min 30min 1 cycle	-40℃/80℃ 100 cycles	___
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hr	___
Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sin wave 11 ms 3 times of each direction	___
Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115mbar 40hrs	___
Others			
Static electricity test	Endurance test applying the electric stress to the finished product housing.	Air Discharge model ±4kv,10 times	___

**** Supply voltage for OLED system =Operating voltage at 25℃*

Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability. After the completion of the described reliability test, the samples were left at room temperature for 2 hrs prior to conducting the functional test at 23±5°C; 55±15% RH.
2. All-pixels on/off exchange is used as operation test pattern.
3. The degradation of Polarizer are ignored for High Temperature storage, High Temperature/ Humidity Storage, Temperature Cycle.
4. No Condensation.

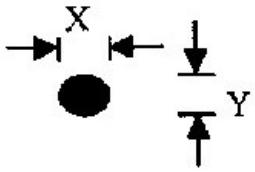
Evaluation criteria

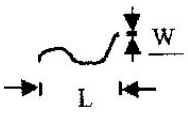
1. The function test is OK.
2. No observable defects.
3. Luminance: > 50% of initial value.
4. Current consumption: within ± 50% of initial value.

Residual image

Because the pixels are lighted in different time, the luminance of active pixels may reduce or differ from inactive pixels. Therefore, the residue image will occur. To avoid the residue image, every pixel needs to be lighted up uniformly.

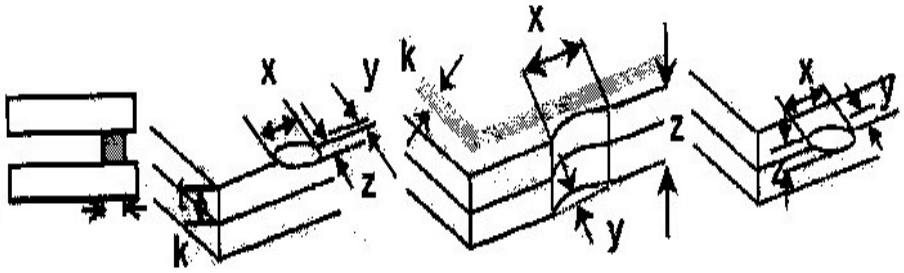
9. Inspection specification

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>01</td><td>Electrical Testing</td><td>1.1 Missing vertical, horizontal segment, segment contrast defect.
1.2 Missing character, dot or icon.
1.3 Display malfunction.
1.4 No function or no display.
1.5 Current consumption exceeds product specifications.
1.6 OLED viewing angle defect.
1.7 Mixed product types.
1.8 Contrast defect.</td><td>0.65</td></tr>
<tr><td>02</td><td>Black or white spots on OLED (display only)</td><td>2.1 White and black spots on display ≦0.25mm, no more than three white or black spots present.
2.2 Densely spaced: No more than two spots or lines within 3mm.</td><td>2.5</td></tr>
<tr><td>03</td><td>OLED black spots, white spots, contamination (non-display)</td><td>3.1 Round type : As following drawing
Φ=(x + y) / 2
 

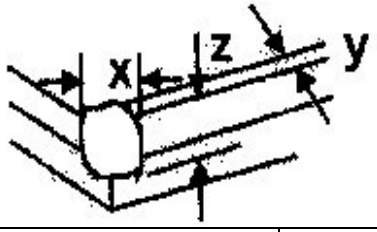
<table>
<tr><th>SIZE</th><th>Acceptable Q TY</th></tr>
<tr><td>Φ≦0.10</td><td>Accept no dense</td></tr>
<tr><td>0.10＜ Φ≦0.20</td><td>2</td></tr>
<tr><td>0.20＜ Φ≦0.25</td><td>1</td></tr>
<tr><td>0.25＜Φ</td><td>0</td></tr>
</table></td><td>2.5</td></tr>
<tr><td></td><td></td><td>3.2 Line type : (As following drawing)
 

<table>
<tr><th>Length</th><th>Width</th><th>Acceptable Q TY</th></tr>
<tr><td>---</td><td>W≦0.02</td><td>Accept no dense</td></tr>
<tr><td>L≦3.0</td><td>0.02＜W≦0.03</td><td rowspan="2">2</td></tr>
<tr><td>L≦2.5</td><td>0.03＜W≦0.05</td></tr>
<tr><td>---</td><td>0.05＜W</td><td>As round type</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>04</td><td>Polarizer bubbles</td><td><table>
<tr><th>Size Φ</th><th>Acceptable Q TY</th></tr>
<tr><td>Φ≦0.20</td><td>Accept no dense</td></tr>
<tr><td>0.20＜Φ≦0.50</td><td>3</td></tr>
<tr><td>0.50＜Φ≦1.00</td><td>2</td></tr>
<tr><td>1.00＜Φ</td><td>0</td></tr>
</table></td><td>2.5</td></tr>
</table>

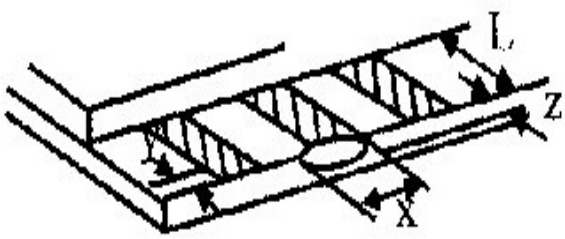
<table>
<tr><td></td><td></td><td>
<table>
<tr><td>Total Q TY</td><td>3</td></tr>
</table>
If bubbles are visible,
judge using black spot specifications, not easy to find, must check in specify direction.</td><td></td></tr>
<tr><td>NO</td><td>Item</td><td>Criterion</td><td>AQL</td></tr>
<tr><td>05</td><td>Scratches</td><td>Follow NO.3 OLED black spots, white spots, contamination</td><td></td></tr>
<tr><td>06</td><td>Chipped glass</td><td>Symbols Define:
x: Chip length y: Chip width z: Chip thickness
k: Seal width t: Glass thickness a: OLED side length
L: Electrode pad length:

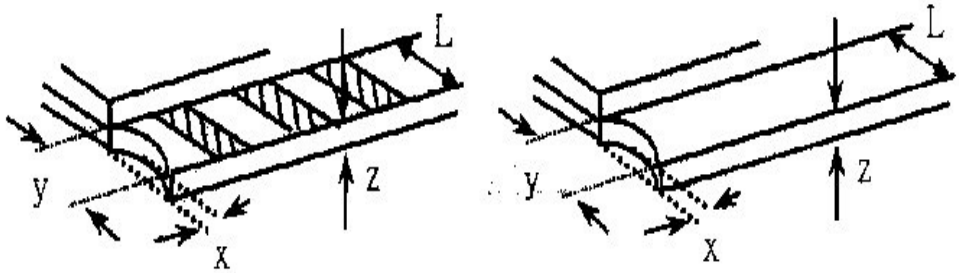
6.1 General glass chip :
6.1.1 Chip on panel surface and crack between panels:
 

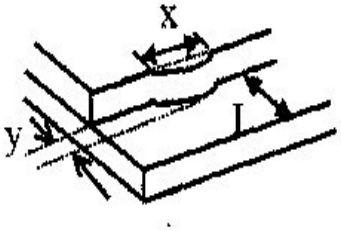
<table>
<tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr>
<tr><td>Z≦1/2t</td><td>Not over viewing area</td><td>x≦1/8a</td></tr>
<tr><td>1/2t＜z≦2t</td><td>Not exceed 1/3k</td><td>x≦1/8a</td></tr>
</table>
⊙If there are 2 or more chips, x is total length of each chip.

6.1.2 Corner crack:
 

<table>
<tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr>
<tr><td>Z≦1/2t</td><td>Not over viewing area</td><td>x≦1/8a</td></tr>
<tr><td>1/2t＜z≦2t</td><td>Not exceed 1/3k</td><td>x≦1/8a</td></tr>
</table>
⊙If there are 2 or more chips, x is the total length of each chip.</td><td>2.5</td></tr>
</table>

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>06</td><td>Glass crack</td><td>
Symbols :
x: Chip length y: Chip width z: Chip thickness
k: Seal width t: Glass thickness a: OLED side length
L: Electrode pad length
6.2 Protrusion over terminal :
6.2.1 Chip on electrode pad :


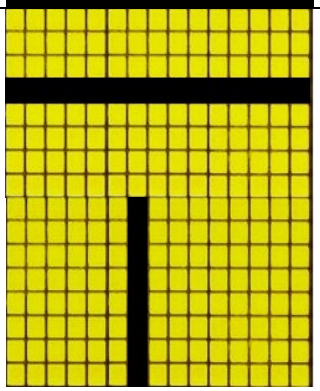
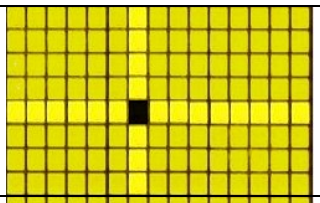
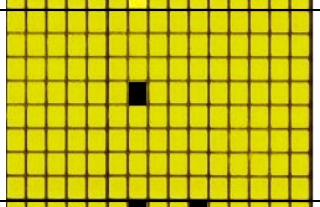
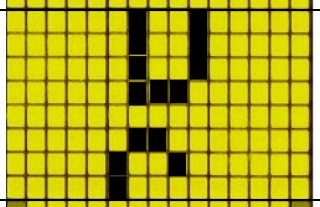
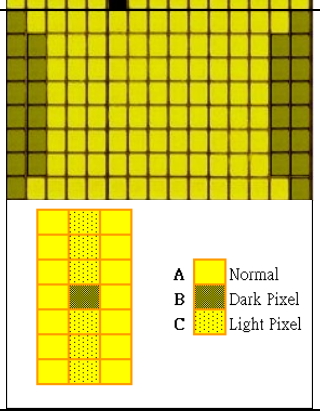
<table>
<tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr>
<tr><td>y≦0.5mm</td><td>x≦1/8a</td><td>0 ＜ z ≦ t</td></tr>
</table>
6.2.2 Non-conductive portion:


<table>
<tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr>
<tr><td>y≦ L</td><td>x≦1/8a</td><td>0 ＜ z ≦ t</td></tr>
</table>
⊙If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.
⊙If the product will be heat sealed by the customer, the alignment mark not be damaged.
6.2.3 Substrate protuberance and internal crack.


<table>
<tr><td>y: width</td><td>x: length</td></tr>
<tr><td>y≦1/3L</td><td>x ≦ a</td></tr>
</table>
</td><td>2.5</td></tr>
</table>

NO	Item	Criterion	AQL
07	Cracked glass	The OLED with extensive crack is not acceptable.	2.5
08	Backlight elements	8.1 Illumination source flickers when lit. 8.2 Spots or scratched that appear when lit must be judged. Using OLED spot, lines and contamination standards. 8.3 Backlight doesn't light or color wrong.	0.65 2.5 0.65
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination. 9.2 Bezel must comply with job specifications.	2.5 0.65
10	PCB、COB	10.1 COB seal may not have pinholes larger than 0.2mm or contamination. 10.2 COB seal surface may not have pinholes through to the IC. 10.3 The height of the COB should not exceed the height indicated in the assembly diagram. 10.4 There may not be more than 2mm of sealant outside the seal area on the PCB. And there should be no more than three places. 10.5 No oxidation or contamination PCB terminals. 10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts. 10.7 The jumper on the PCB should conform to the product characteristic chart. 10.8 If solder gets on bezel tab pads, OLED pad, zebra pad or screw hold pad, make sure it is smoothed down.	2.5 2.5 0.65 2.5 2.5 0.65 0.65 2.5
11	Soldering	11.1 No un-melted solder paste may be present on the PCB. 11.2 No cold solder joints, missing solder connections, oxidation or icicle. 11.3 No residue or solder balls on PCB. 11.4 No short circuits in components on PCB.	2.5 2.5 2.5 0.65

NO	Item	Criterion	AQL
12	General appearance	12.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP. 12.2 No cracks on interface pin (OLB) of TCP. 12.3 No contamination, solder residue or solder balls on product. 12.4 The IC on the TCP may not be damaged, circuits. 12.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever. 12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color. 12.7 Sealant on top of the ITO circuit has not hardened. 12.8 Pin type must match type in specification sheet. 12.9 OLED pin loose or missing pins. 12.10 Product packaging must the same as specified on packaging specification sheet. 12.11 Product dimension and structure must conform to product specification sheet.	2.5 0.65 2.5 2.5 2.5 2.5 2.5 0.65 0.65 0.65 0.65

Check Item	Classification	Criteria
No Display	Major	
Missing Line	Major	
Pixel Short	Major	
Darker Short	Major	
Wrong Display	Major	
Un-uniform B/A x 100% < 70% A/C x 100% < 70%	Major	

10. Precautions in use of OLED Modules

(1) Avoid applying excessive shocks to module or making any alterations or modifications to it.
(2) Don't make extra holes on the printed circuit board, change the components or modify its shape of OLED display module.
(3) Don't disassemble the OLED display module.
(4) Do not apply input signals while the logic power is off.
(5) Don't operate it above the absolute maximum rating.
(6) Don't drop, bend or twist OLED display module.
(7) Soldering: only to the I/O terminals.
(8) Hot-Bar FPC soldering condition: 280~350C, less than 5 seconds.
(9) DISPLAY VISIONS has the right to change the passive components (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.) and change the PCB Rev. (In order to satisfy the supplying stability, management optimization and the best product performance...etc, under the premise of not affecting the electrical characteristics and external dimensions, DISPLAY VISIONS have the right to modify the version.)
(10) DISPLAY VISIONS has the right to upgrade or modify the product function.
(11) For COG & COF structure OLED products, customers should reserve VCC (VPP) adjustment function or software update function when designing OLED supporting circuit. (The progress of OLED light-emitting materials will increase the conversion efficiency and the brightness. The brightness can be adjusted if necessary).

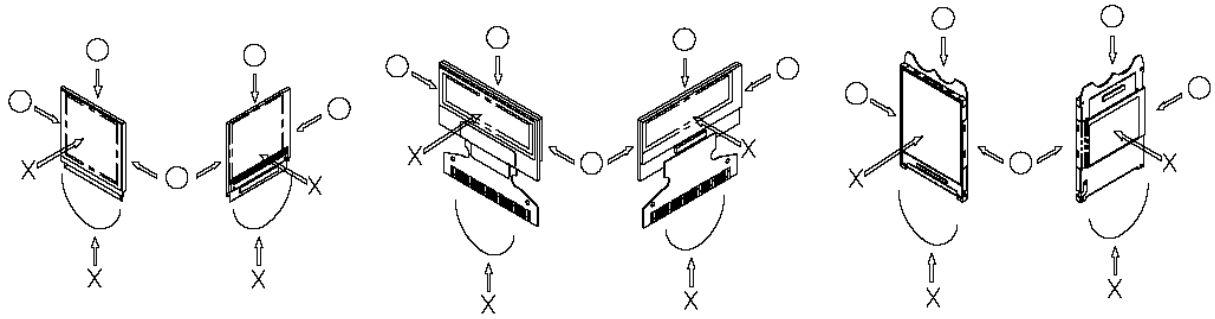
11.1. Handling Precautions

(1) Since the display panel is being made of glass, do not apply mechanical impacts such as 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 OLED display module, the cell structure may be damaged. So, be careful not to apply pressure to these sections.
(4) The polarizer covering the surface of the OLED display module is soft and easily scratched.
(5) When the surface of the polarizer of the OLED display module has soil, clean the surface. It takes advantage 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) 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 OLED 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.

(7) Do not touch the following sections whenever possible while handling the OLED display modules.
* Pins and electrodes
* Pattern layouts such as the TCP & FPC

(8) Hold OLED display module very carefully when placing OLED display module into the System housing. Do not apply excessive stress or pressure to OLED 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.



(9) Do not apply stress to the LSI chips and the surrounding molded sections.

(10) Pay sufficient attention to the working environments when handing OLED display modules to prevent occurrence of element breakage accidents by static electricity.
* Be sure to make human body grounding when handling OLED 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 OLED display module. Be careful since static electricity may be generated when exfoliating the protective film.

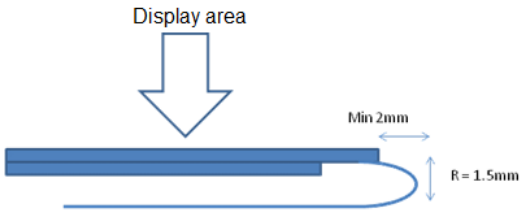
11.2. Storage Precautions

(11) When storing OLED display modules, put them in static electricity preventive bags to avoid be directly exposed to sun or lights of fluorescent lamps. And, also, place in the temperature 25±5°C and Humidity below 65% RH.(We recommend you to store these modules in the packaged state when they were shipped from DISPLAY VISIONS. At that time, be careful not to let water drops adhere to the packages or bags.)

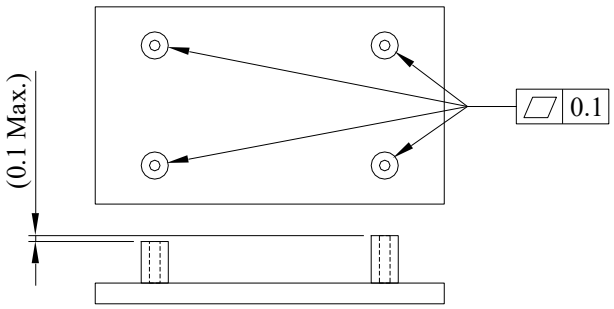
(12) When the OLED display module is being dewed or when it is placed under high temperature or high humidity environments, the electrodes may be corroded if electric current is applied. Please store it in clean environment.

11.3. Designing Precautions

(1) The absolute maximum ratings are the ratings which cannot be exceeded for OLED display module, and if these values are exceeded, OLED display module may be damaged.
(2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specification and 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 (VDD / VCC). (Recommend value: 0.5A)
(4) Pay sufficient attention to avoid occurrence of mutual noise interference with the nearby devices.
(5) As for EMI, take necessary measures on the equipment side basically.
(6) If the power supplied to the OLED display module is forcibly shut down by such errors as taking out the main battery while the OLED display panel is in operation, we cannot guarantee the quality of this OLED display module.
* Connection (contact) to any other potential than the above may lead to rupture of the IC.
(7) If this OLED driver is exposed to light, malfunctioning may occur and semiconductor elements may change their characteristics.
(8) The internal status may be changed, if excessive external noise enters into the module. Therefore, it is necessary to take appropriate measures to suppress noise generation or to protect module from influences of noise on the system design.
(9) We recommend you 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.
(10) It's pretty common to use "Screen Saver" to extend the lifetime and Don't use the same image for long time in real application. When an OLED display module is operated for a long of time with fixed pattern, an afterimage or slight contrast deviation may occur.
(11) The limitation of FPC and Film bending.



(12) The module should be fixed balanced into the housing, or the module may be twisted.



(13) Please heat up a little the tape sticking on the components when removing it; otherwise the components might be damaged.

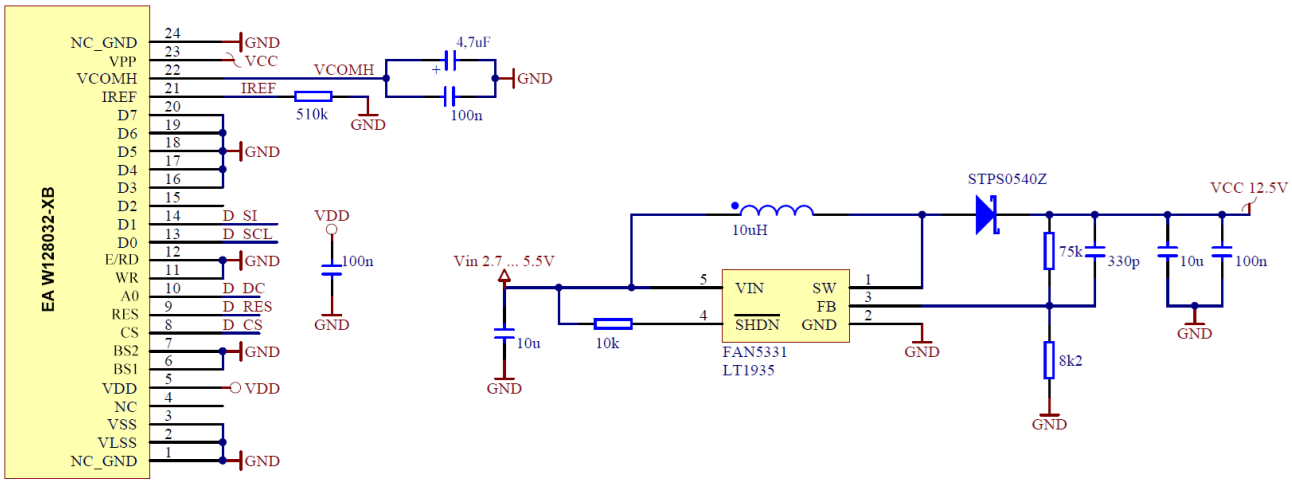
11.4. Precautions when disposing of the OLED display modules

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

11. Initialization example

```
void INIT_SH1106(){
    WriteCommand(0xAE); //display off

    WriteCommand(0xB0); //set page address
    WriteCommand(0x10); //set higher column address
    WriteCommand(0x04); //set lower column address

    WriteCommand(0xA4); //set entire display off

    WriteCommand(0xD5); //set display clock divide ratio/oscillator frequency
    WriteCommand(0x51);

    WriteCommand(0xA8); //set multiplex ration
    WriteCommand(0x1F);

    WriteCommand(0xD3); //set display offset
    WriteCommand(0x00);

    WriteCommand(0x40); //set display start line

    WriteCommand(0xAD); //set DC-DC
    WriteCommand(0x8A);

    WriteCommand(0xA1); //set segment re-map

    WriteCommand(0xC8); //set common output scan direction

    WriteCommand(0xDA); //set common pads hardware configuration
    WriteCommand(0x12);

    WriteCommand(0x81); //set contrast control register
    WriteCommand(0x2F);

    WriteCommand(0xD9); //set dis-charge/pre-charge period
    WriteCommand(0x22);

    WriteCommand(0xDB); //set VCOM deselect level
    WriteCommand(0x35);

    WriteCommand(0xA6); //set normal display

    WriteCommand(0xAF); //display on
}
```

12. Application example (SPI)



13. Differences EA W128032-XA and -XB

	EA W128032-XA	EA W128032-XB	Unit
Onboard Controller	SSD1305	SH1106	
Thickness	2.35	2.17	mm
Current consumption	15 (typ.)	9 (typ.)	mA
R_{IREF}	910	510	kΩ
Software commands	0x20, 0xAD, 0xD5, 0xD9, 0xDB	n/a, 0xAD, 0xD5, 0xD9, 0xDB	
Contrast	1:2000	1:10000	

For more details see following document:
https://www.lcd-module.de/eng/pdf/zubehoer/comparsion_SSD1305-SH1106.pdf