RAYSTAR

SPECIFICATION

OLED SPECIFICATION

Model No:

REX001602CYPP5N00000

CUSTOMER:

APPROVED BY	
PCB VERSION	
DATE	

FOR CUSTOMER USE ONLY

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

Release DATE:

1. Revision History

VERSION	DATE	REVISED PAGE NO.	Note
0	2014/09/18		First release

Contents

1.General Specification

The Features is described as follow:

- Module dimension: 68.5 x 17.5 x 2.05 (max.) mm
- View area: 58.22 x 13.52 mm
- Active area: 56.22 x 11.52 mm
- Number of dots: 16 Character x 2 Line
- Dot size: 0.57 x 0.67 mm
- Dot pitch: 0.60x 0.70 mm
- Character size: 2.97 x 5.57 mm
- Character pitch: 3.55 x 5.95 mm
- Duty: 1/16
- Panel type: OLED , Yellow
- IC: SSD1311

2.Module Coding System

1	2	3	4	5	6	7	8	9	10	11	12	13
R	E	X	001602	C	Y	P	P	5	N	0	0	000

Item	Description		
1	R：Raystar Optronics Inc.		
2	E：OLED		
3	Display Type: C→Character Type, G→Graphic Type,T→TAB Type ,X→COG Type		
4	Dot Matrix： 16* 02		
5	Serials code		
6	Emitting Color	A：Amber	R：RED
		B：Blue	Y：Yellow
		G：Green	W：White
7	Polarizer	P：With Polarizer; N: Without Polarizer	
8	Display Mode	P：Passive Matrix ; A: Active Matrix	
9	Driver Voltage	3: 3.0 V; 5: 5.0V	
10	Touch Panel	N：Without touch panel; T: With touch panel S：Resistive touch panel	
11	Species	0:Normal, 1:Sunlight readable, 2:Transparent, 3:Flexible, 4:Lighting	
12	Grade code		
13	Serial No.	Sales code	

3.Interface Pin Function

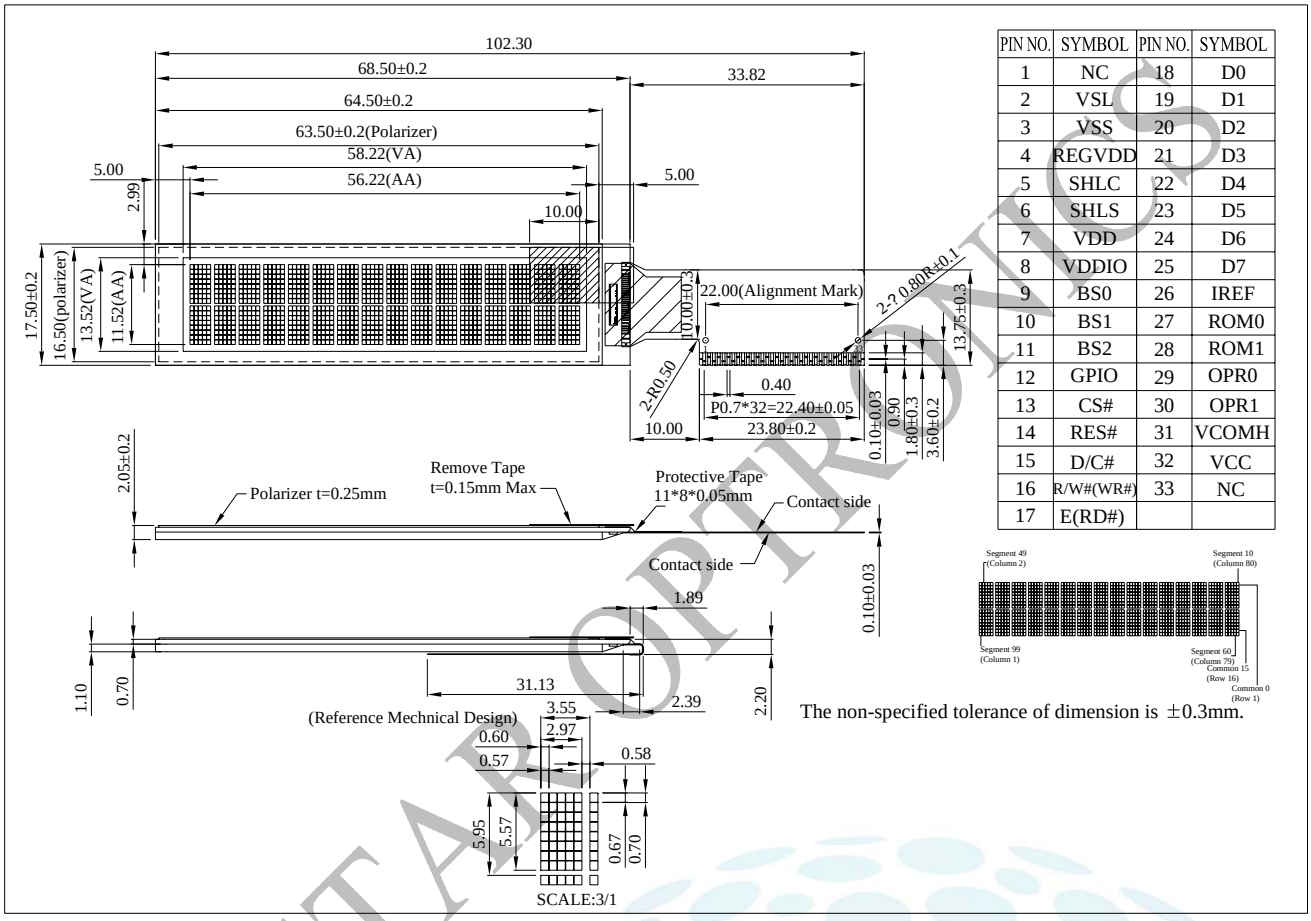
<table>
<tr><th>Pin No.</th><th>Symbol</th><th>Pin Type</th><th>Description</th></tr>
<tr><td>1</td><td>NC</td><td>—</td><td>No connection</td></tr>
<tr><td>2</td><td>VSL</td><td>P</td><td>This is segment voltage (output low level) reference pin.
When external VSL is not used, this pin should be left open.
When external VSL is used, connect with resistor and diode to ground (details depend on application).</td></tr>
<tr><td>3</td><td>VSS</td><td>P</td><td>Ground pin. It must be connected to external ground.</td></tr>
<tr><td>4</td><td>REGVDD</td><td>I</td><td>Internal VDD regulator selection pin in 5V I/O application mode.
When this pin is pulled HIGH, internal VDD regulator is enabled (5V I/O application).
When this pin is pulled LOW, internal VDD regulator is disabled (Low voltage I/O application).</td></tr>
<tr><td>5</td><td>SHLC</td><td>I</td><td>This pin is used to determine the Common output scanning direction.
COM scan direction
<table>
<tr><td>SHLC</td><td>COM scan direction</td></tr>
<tr><td>1</td><td>COM0 to COM31 (Normal)</td></tr>
<tr><td>0</td><td>COM31 to COM0 (Reverse)</td></tr>
</table>
Note
(1) 0 is connected to VSS
(2) 1 is connected to VDDIO</td></tr>
<tr><td>6</td><td>SHLS</td><td>I</td><td>This pin is used to change the mapping between the display data column address and the Segment driver.
SEG scan direction
<table>
<tr><td>SHLS</td><td>SEG direction</td></tr>
<tr><td>1</td><td>SEG0 to SEG99 (Normal)</td></tr>
<tr><td>0</td><td>SEG99 to SEG0 (Reverse)</td></tr>
</table>
Note
(1) 0 is connected to VSS
(2) 1 is connected to VDDIO</td></tr>
<tr><td>7</td><td>VDD</td><td>P</td><td>Power supply for core logic operation.
VDD can be supplied externally or regulated internally.
In LV IO application (internal VDD is disabled), this is a power input pin.
In 5V IO application (internal VDD is enabled), VDD is regulated internally from VDDIO.
A capacitor should be connected between VDD and VSS under all circumstances.</td></tr>
</table>

<table>
<tr><td>8</td><td>VDDIO</td><td>P</td><td>Low voltage power supply and power supply for interface logic level in both Low Voltage I/O and 5V I/O application. It should match with the MCU interface voltage level and must be connected to external source.</td></tr>
<tr><td>9</td><td>BS0</td><td rowspan="3">I</td><td rowspan="3">MCU bus interface selection pins. Select appropriate logic setting as described in the following table. BS2, BS1 and BS0 are pin select.
Bus Interface selection
<table><tr><td>BS[2:0]</td><td>Interface</td></tr><tr><td>000</td><td>Serial Interface</td></tr><tr><td>001</td><td>Invalid</td></tr><tr><td>010</td><td>I²C</td></tr><tr><td>011</td><td>Invalid</td></tr><tr><td>100</td><td>8-bit 6800 parallel</td></tr><tr><td>101</td><td>4-bit 6800 parallel</td></tr><tr><td>110</td><td>8-bit 8080 parallel</td></tr><tr><td>111</td><td>4-bit 8080 parallel</td></tr></table>Note
(1) 0 is connected to VSS
(2) 1 is connected to VDDIO</td></tr>
<tr><td>10</td><td>BS1</td></tr>
<tr><td>11</td><td>BS2</td></tr>
<tr><td>12</td><td>GPIO</td><td>I/O</td><td>It is a GPIO pin. Details refer to OLED command DCh.</td></tr>
<tr><td>13</td><td>CS#</td><td>I</td><td>This pin is the chip select input connecting to the MCU.
The chip is enabled for MCU communication only when CS# is pulled LOW (active LOW).
In I2C mode, this pin must be connected to VSS.</td></tr>
<tr><td>14</td><td>RES#</td><td>I</td><td>This pin is reset signal input.
When the pin is pulled LOW, initialization of the chip is executed.
Keep this pin pull HIGH during normal operation.</td></tr>
<tr><td>15</td><td>D/C#</td><td>I</td><td>This pin is Data/Command control pin connecting to the MCU.
When the pin is pulled HIGH, the data at D[7:0] will be interpreted as data.
When the pin is pulled LOW, the data at D[7:0] will be transferred to a command register.
In I2C mode, this pin acts as SA0 for slave address selection.
When serial interface is selected, this pin must be connected to VSS.</td></tr>
<tr><td>16</td><td>R/W#(WR#)</td><td>I</td><td>This pin is read / write control input pin connecting to the MCU interface.
When 6800 interface mode is selected, this pin will be used as Read/Write (R/W#) selection input. Read mode will be carried out when this pin is pulled HIGH and write mode when LOW.
When 8080 interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled LOW and the chip is selected.
When serial or I2C interface is selected, this pin must be connected to VSS.</td></tr>
</table>

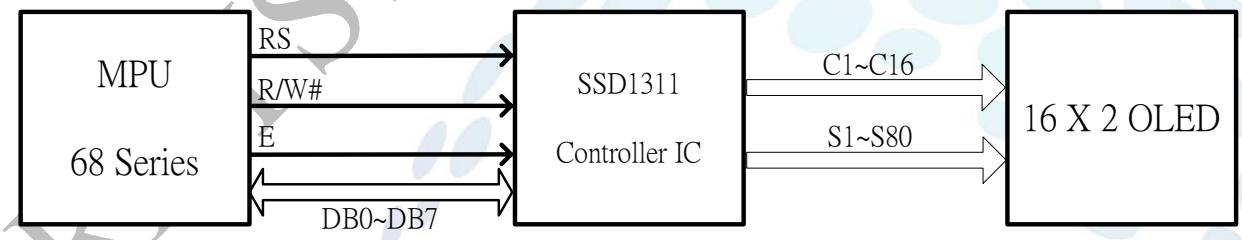
<table>
<tr><td>17</td><td>E(RD#)</td><td>I</td><td>This pin is MCU interface input.
When 6800 interface mode is selected, this pin will be used as the Enable (E) signal.
Read/write operation is initiated when this pin is pulled HIGH and the chip is selected.
When 8080 interface mode is selected, this pin receives the Read (RD#) signal. Read operation is initiated when this pin is pulled LOW and the chip is selected.
When serial or I2C interface is selected, this pin must be connected to VSS.</td></tr>
<tr><td>18</td><td>D0</td><td rowspan="8">I/O</td><td rowspan="8">These pins are bi-directional data bus connecting to the MCU data bus.
Unused pins are recommended to tie LOW.
When serial interface mode is selected, D0 will be the serial clock input: SCLK; D1 will be the serial data input: SID and D2 will be the serial data output: SOD.
When I2C mode is selected, D2, D1 should be tied together and serve as SDAout, SDAin in application and D0 is the serial clock input, SCL.</td></tr>
<tr><td>19</td><td>D1</td></tr>
<tr><td>20</td><td>D2</td></tr>
<tr><td>21</td><td>D3</td></tr>
<tr><td>22</td><td>D4</td></tr>
<tr><td>23</td><td>D5</td></tr>
<tr><td>24</td><td>D6</td></tr>
<tr><td>25</td><td>D7</td></tr>
<tr><td>26</td><td>IREF</td><td>I</td><td>This pin is the segment output current reference pin.
IREF is supplied externally.
A resistor should be connected between this pin and VSS to maintain current of around 15uA.</td></tr>
<tr><td>27</td><td>ROM0</td><td rowspan="2">I</td><td rowspan="2">These pins are used to select Character ROM; select appropriate logic setting as described in the following table.
ROM1 and ROM0 are pin select as shown in below table:
Character ROM selection
<table>
<tr><th>ROM1</th><th>ROM0</th><th>ROM</th></tr>
<tr><td>0</td><td>0</td><td>A</td></tr>
<tr><td>0</td><td>1</td><td>B</td></tr>
<tr><td>1</td><td>0</td><td>C</td></tr>
<tr><td>1</td><td>1</td><td>S/W selectable (3)</td></tr>
</table>
Note
(1) 0 is connected to VSS
(2) 1 is connected to VDDIO</td></tr>
<tr><td>28</td><td>ROM1</td></tr>
<tr><td>29</td><td>OPR0</td><td>I</td><td>This pin is used to select the character number of character generator.
Character RAM selection</td></tr>
</table>

<table>
<tr><td>30</td><td>OPR1</td><td></td><td>
<table>
<tr><th>OPR1</th><th>OPR0</th><th>CGROM</th><th>CGRAM</th></tr>
<tr><td>1</td><td>1</td><td>256</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>248</td><td>8</td></tr>
<tr><td>1</td><td>0</td><td>250</td><td>6</td></tr>
<tr><td>0</td><td>0</td><td>240</td><td>8</td></tr>
</table>
Note
(1) 0 is connected to VSS
(2) 1 is connected to VDDIO</td></tr>
<tr><td>31</td><td>VCOMH</td><td>P</td><td>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.</td></tr>
<tr><td>32</td><td>VCC</td><td>P</td><td>Power supply for panel driving voltage. This is also the most positive power voltage supply pin. It is supplied by external high voltage source.</td></tr>
<tr><td>33</td><td>NC</td><td>—</td><td>No connection</td></tr>
</table>

4.Counter Drawing & Block Diagram



PIN NO.	SYMBOL	PIN NO.	SYMBOL
1	NC	18	D0
2	VSL	19	D1
3	VSS	20	D2
4	REGVDD	21	D3
5	SHLC	22	D4
6	SHLS	23	D5
7	VDD	24	D6
8	VDDIO	25	D7
9	BS0	26	IREF
10	BS1	27	ROM0
11	BS2	28	ROM1
12	GPIO	29	OPR0
13	CS#	30	OPR1
14	RES#	31	VCOMH
15	D/C#	32	VCC
16	R/W#(WR#)	33	NC
17	E(RD#)		



Display Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM Address	00	01														0F
DD RAM Address	40	41														4F

5.Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Notes
Supply Voltage For Logic	VDDIO	-0.3	6.0	V	
Operating Temperature	T_{OP}	-40	+80	℃	
Storage Temperature	T_{ST}	-40	+80	℃	

Note 1: All the above voltages are on the basis of “VSS = 0V”.
Note 2: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also, for normal operations, it is desirable to use this module under the conditions according to Section 5 ‘’Electrical Characteristics’’. If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate

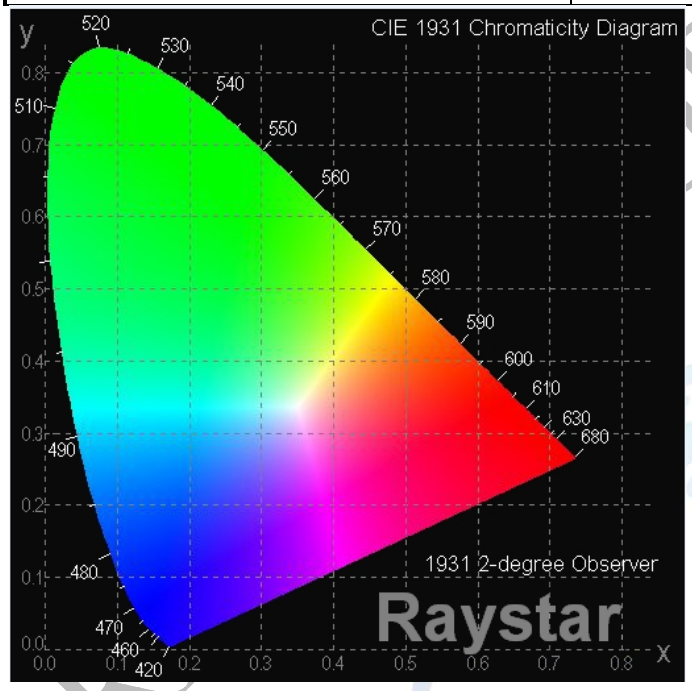
6.Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	VDDIO	—	4.8	5.0	5.3	V
Supply Voltage for Display	VCC	—	10	12	15	V
Input High Volt.	VIH	—	0.8 VDD	—	—	V
Input Low Volt.	VIL	—	—	—	0.2VDD	V
Output High Volt.	VOH	IOH=-0.5mA	0.9 VDD	—	—	V
Output Low Volt.	VOL	IOL=0.5mA	—	—	0.1 VDD	V
50% Check Board Operating Current	ICC	VCC=12V	14	16	18	mA

Note: When you use 5V for Vddio please don't use 3V or 3.3V for logic I/O this will cause module does not work.

7.Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V)θ	—	160	—	—	deg
	(H)φ	—	160	—	—	deg
Contrast Ratio	CR	Dark	2000:1	—	—	—
Response Time	T rise	—	—	10	—	μs
	T fall	—	—	10	—	μs
Display with 50% check Board Brightness			90	110	—	—
CIEx(Yellow)		x,y(CIE1931)	0.45	0.47	0.49	—
CIEy(Yellow)		x,y(CIE1931)	0.48	0.50	0.52	—



8.OLED Lifetime

ITEM	Conditions	Min	Typ	Remark
Operating Life Time	Ta=25℃ / Initial 50% check Board Typical Brightness Value	80,000 Hrs	100,000 Hrs	Note

Note:

1. Life time is defined the amount of time when the luminance has decayed to <50% of the initial value.
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.

9.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. -40℃ 25℃ 80℃ 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 terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	——

*** 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 failure test at 23±5°C; 55±15% RH.
2. All-pixels-on is used as operation test pattern.
3. The degradation of Polarizer are ignored for High Temperature storage, High Temperature/ Humidity Storage, Temperature Cycle

Evaluation criteria

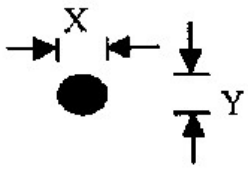
1. The function test is OK.
2. No observable defects.
3. Luminance: > 50% of initial value.
4. Current consumption: within ± 50% of initial value.

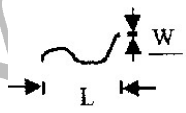
APPENDIX:

RESIDUE 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.

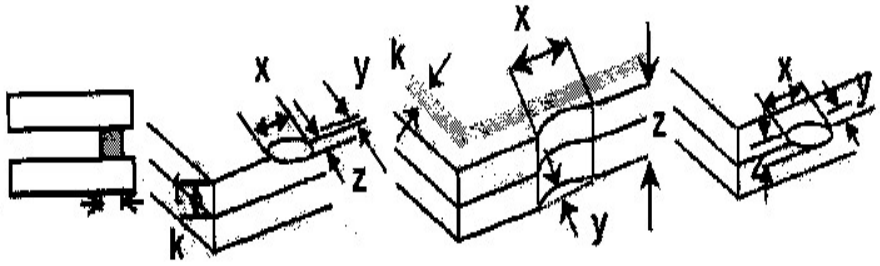
10.Inspection specification

<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
 

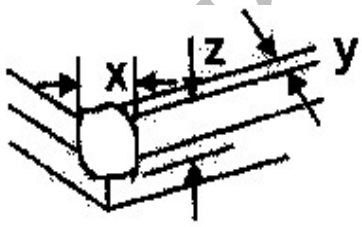
<table>
<tr><th>SIZE</th><th>Acceptable Q TY</th></tr>
<tr><td>Φ≦0.10</td><td>Accept no dense</td></tr>
<tr><td>0.10＜ Φ≦0.20</td><td>2</td></tr>
<tr><td>0.20＜ Φ≦0.25</td><td>1</td></tr>
<tr><td>0.25＜Φ</td><td>0</td></tr>
</table></td><td>2.5</td></tr>
<tr><td></td><td></td><td>3.2 Line type : (As following 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>If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.
<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>
<tr><td>Total Q TY</td><td>3</td></tr>
</table></td><td>2.5</td></tr>
</table>

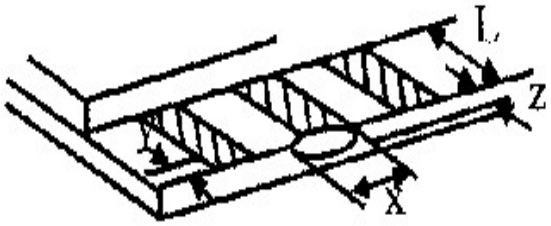
<table>
<tr><td>NO</td><td>Item</td><td>Criterion</td><td>AQL</td></tr>
<tr><td>05</td><td>Scratches</td><td colspan="2">Follow NO.3 OLED black spots, white spots, contamination</td></tr>
<tr><td>06</td><td>Chipped glass</td><td>Symbols Define:
x: Chip length y: Chip width z: Chip thickness
k: Seal width t: Glass thickness a: OLED side length
L: Electrode pad length:

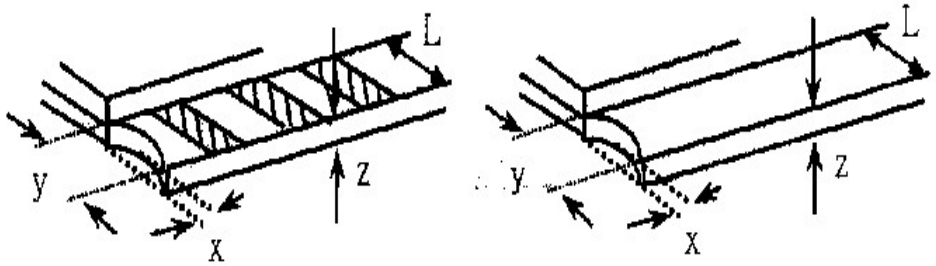
6.1 General glass chip :
6.1.1 Chip on panel surface and crack between panels:
 

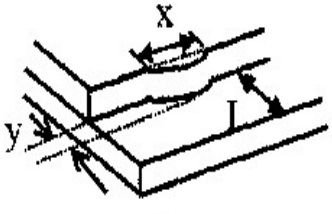
<table><tr><td>z: Chip thickness</td><td>y: Chip width</td><td>x: Chip length</td></tr><tr><td>Z≦1/2t</td><td>Not over viewing area</td><td>x≦1/8a</td></tr><tr><td>1/2t＜z≦2t</td><td>Not exceed 1/3k</td><td>x≦1/8a</td></tr></table>⊙If there are 2 or more chips, x is total length of each chip.

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 :


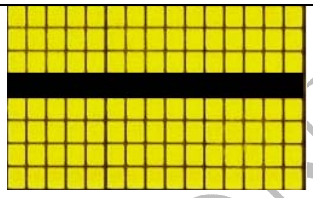
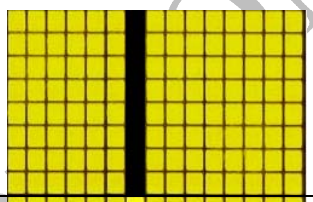
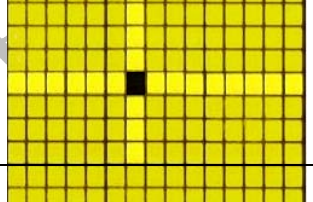
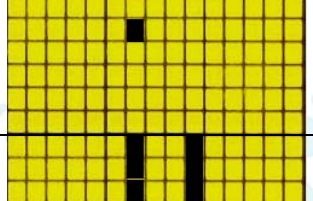
<table>
<tr><td>y: Chip width</td><td>x: Chip length</td><td>z: Chip thickness</td></tr>
<tr><td>y≦0.5mm</td><td>x≦1/8a</td><td>0 ＜ z ≦ t</td></tr>
</table>
6.2.2 Non-conductive portion:


<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