![Vishay logo]

Vishay Dale Electronics, LLC Information Display Products

OLED Product Data Sheet

OLED SPECIFICATION

Model No:

OLED-128O064D-WPP3N000A0

SPECIFICATION   Version: B

Model # :   OLED-128O064D-WPP3N000A0

Global / SAP # :   O128O064DWPP3N000A

APPROVED BY:
(FOR CUSTOMER USE ONLY)

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY
RELEASE DATE:			

■APPROVAL FOR SPECIFICATIONS ONLY

☐APPROVAL FOR SPECIFICATIONS AND SAMPLE (   )

MODEL NO : OLED-128O064D-WPP3N000A0

RECORDS OF REVISION			DOC. FIRST ISSUE
VERSION	DATE	REVISED PAGE NO.	SUMMARY
0	2017/08/28		First release
A	2018/01/22		Modify Reliability test Condition,Add Initial,ICC,CIE
B	2018/11/27		Modify Static electricity test Content of Test

Contents

1.Module Classification Information

OLED- 128 O 064 D- W P P 3 N 0 0 0 A0
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭

1	Brand	Vishay Intertechnology, Inc.	
2	Horizontal Format	128 columns	
3	Display Type (RoHS-compliant)	N：COB Character	H：COB Graphic
		O：COG	F：COG + FRAME
		P：COG + FRAME + PCB	Y：TAB
		A：COG + PCB	
4	Vertical Format	64 rows	
5	Series code	D	
6	Emitting Color	A：Amber	S：Sky Blue
		B：Blue	W：White
		G：Green	X：Dual Color
		L：Yellow	C：Full Color
		R：Red	
7	Polarizer	P：With Polarizer N：Without Polarizer A：Anti-glare Polarizer	
8	Display Mode	P：Passive Matrix ; A: Active Matrix	
9	Driver Voltage	3: 3.0V / 3.3 V; 5: 5.0V	
10	Touch Panel	N：Without TP; T：Resistive TP; D：DCT Attached CTP; R：OCR Attached CTP; A：OCA Attached CTP	
11	Products type	0：Standard type 1：Daylight Readable type 2：Transparent OLED (TOLED) 3：Flexible OLED 4：OLED for Lighting	
12	Inspection Grade	0：Standard 2：Special grade C：Automotive grade Y：Consumer grade	
13	Interface	0：Default; F：ZIF FPC; H：Hotbar FPC; D：Demo Kit	
14	Serial No.	Application serial number (00~ZZ)	

2.General Specification

Item	Dimension	Unit
Dot Matrix	128 x 64 Dots	—
Module dimension	26.70 x 19.26 x 1.26	mm
Active Area	21.738 x 10.858	mm
Pixel Size	0.148 x 0.148	mm
Pixel Pitch	0.17 x 0.17	mm
Display Mode	Passive Matrix	
Display Color	White	
Drive Duty	1/64 Duty	
IC	SSD1306BZ	
Interface	6800,8080,SPI,I2C	
Size	0.96 inch	

3. Contour Drawing & Block Diagram
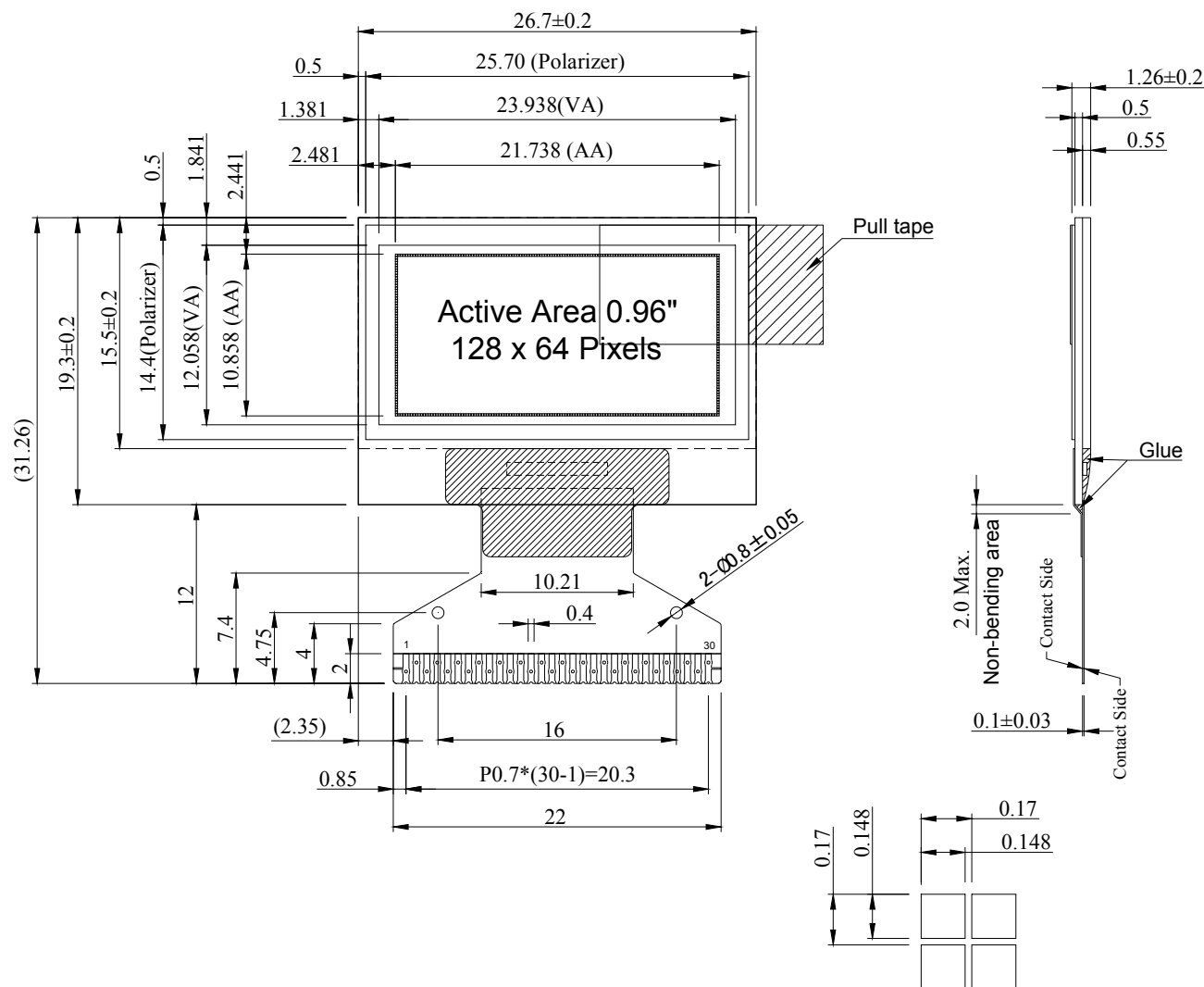
PIN NO.	SYMBOL	PIN NO.	SYMBOL
1	NC(GND)	14	RES#
2	C2N	15	D/C#
3	C2P	16	R/W#
4	C1P	17	E/RD#
5	C1N	18	D0
6	VBAT	19	D1
7	NC	20	D2
8	VSS	21	D3
9	VDD	22	D4
10	BS0	23	D5
11	BS1	24	D6
12	BS2	25	D7
13	CS#	26	IREF
		27	VCOMH
		28	VCC
		29	VLSS
		30	NC(GND)

Active Area 0.96"
128 x 64 Pixels

SCALE: 20/1

OLED-128O064D-WPP3N000A0
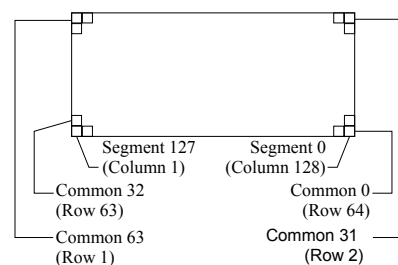
3.1 Application Recommendations
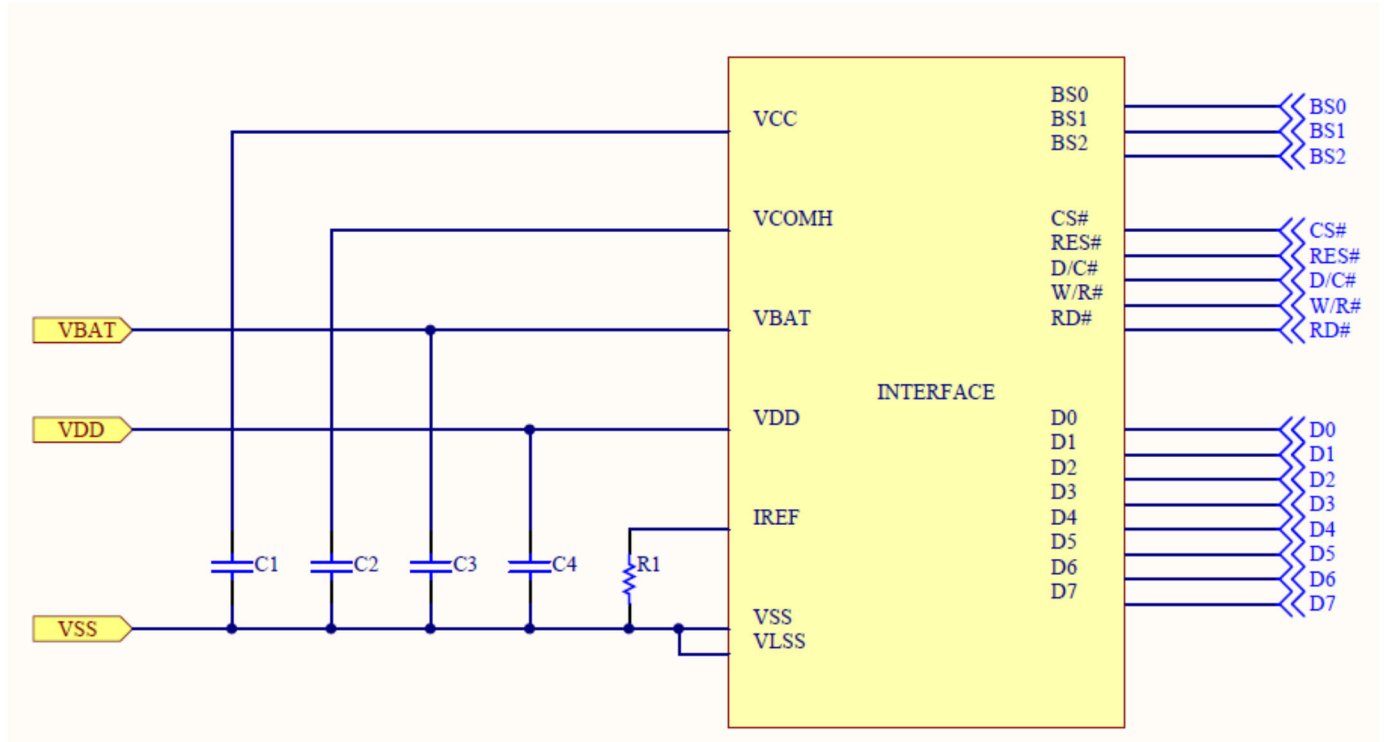
Recommended components：

C1, C2：2.2uF

C3, C4：1.0uF

Bus Interface selection: (BS[2:0] must be set, refer to Section 4.)

- 6800 or 8080 8-bit parallel, 3 or 4-wire SPI, I2C

Voltage at IREF = VCC – 3V.

For external VCC = 12V, IREF = 12.5uA:

R1 = (Voltage at IREF - VSS) / IREF

    = (12 - 3) / 0.0000125

    = 720K ohm

For internal VCC = 7.5V, IREF = 12.5uA:

R1 = (7.5 - 3) / 0.0000125

    = 360K ohm

*For more information, please refer to the SSD1306B video controller datasheet.

4. Interface Pin Function

No.	Symbol	Function
1	N.C. (GND)	*Reserved Pin (Supporting Pin)* The supporting pins can reduce the influences from stresses on the function pins. These pins must be connected to external ground.
2	C2N	*Positive Terminal of the Flying Inverting Capacitor Negative Terminal of the Flying Boost Capacitor* The charge-pump capacitors are required between the terminals. They must be floated when the converter is not used.
3	C2P	
4	C1P	
5	C1N	
6	VBAT	*Power Supply for DC/DC Converter Circuit* This is the power supply pin for the internal buffer of the DC/DC voltage converter. It must be connected to external source when the converter is used. It should be connected to VDD when the converter is not used.
7	NC	NC
8	VSS	*Ground of Logic Circuit* This is a ground pin. It acts as a reference for the logic pins. It must be connected to external ground.
9	VDD	*Power Supply for Logic* This is a voltage supply pin. It must be connected to external source.
10	BS0	*Communicating Protocol Select* These pins are MCU interface selection input. See the following table:
11	BS1	
12	BS2	

	BS0	BS1	BS2
I2C	0	1	0
3-wire SPI	1	0	0
4-wire SPI	0	0	0
8-bit 68XX Parallel	0	0	1
8-bit 80XX Parallel	0	1	1

No.	Symbol	Function
13	CS#	*Chip Select* This pin is the chip select input. The chip is enabled for MCU communication only when CS# is pulled low.
14	RES#	*Power Reset for Controller and Driver* This pin is reset signal input. When the pin is low, initialization of the chip is executed.
15	D/C#	*Data/Command Control* This pin is Data/Command control pin. When the pin is pulled high, the input at D7~D0 is treated as display data. When the pin is pulled low, the input at D7~D0 will be transferred to the command register. For detail relationship to MCU interface signals, please refer to the Timing Characteristics Diagrams. When the pin is pulled high and serial interface mode is selected, the data at SDIN is treated as data. When it is pulled low, the data at SDIN will be transferred to the command register. In I2C mode, this pin acts as SA0 for slave address selection.

16	R/W#	*Read/Write Select or Write* This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Pull this pin to "High" for read mode and pull it to "Low" for write mode. When 80XX 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 CS# is pulled low.
17	E/RD#	*Read/Write Enable or Read* This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled high and the CS# is pulled low. When connecting to an 80XX-microprocessor, this pin receives the Read (RD#) signal. Data read operation is initiated when this pin is pulled low and CS# is pulled low.
18~25	D0~D7	*Host Data Input/Output Bus* These pins are 8-bit bi-directional data bus to be connected to the microprocessor's data bus. When serial mode is selected, D1 will be the serial data input SDIN and D0 will be the serial clock input SCLK. When I2C mode is selected, D2 & D1 should be tired together and serve as SDAout & SDAin in application and D0 is the serial clock input SCL.
26	IREF	*Current Reference for Brightness Adjustment* This pin is segment current reference pin. A resistor should be connected between this pin and VSS. Set the current lower than 12.5μA.
27	VCOMH	*Voltage Output High Level for COM Signal* This pin is the input pin for the voltage output high level for COM signals. A capacitor should be connected between this pin and VSS.
28	VCC	*Power Supply for OEL Panel* This is the most positive voltage supply pin of the chip. A stabilization capacitor should be connected between this pin and VSS when the converter is used. It must be connected to external source when the converter is not used.
29	VLSS	*Ground of Analog Circuit* This is an analog ground pin. It should be connected to VSS externally.
30	NC (GND)	*Reserved Pin (Supporting Pin)* The supporting pins can reduce the influences from stresses on the function pins. These pins must be connected to external ground.

5.Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	VDD	0	4.0	V	1,2
Supply Voltage for Display	VCC	0	15.0	V	1,2
Operating Temperature	TOP	-40	+80	°C	—
Storage Temperature	TSTG	-40	+85	°C	—

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 6."Optics & 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

6.1 DC Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	VDD	—	2.8	3.0	3.3	V
Supply Voltage for Display	VCC	—	11.5	12.0	12.5	V
Input High Volt.	VIH	—	0.8×VDD	—	VDDIO	V
Input Low Volt.	VIL	—	0	—	0.2×VDD	V
Output High Volt.	VOH	—	0.9×VDD	—	VDDIO	V
Output Low Volt.	VOL	—	0	—	0.1×VDD	V
Operating Current for VCC (50% display ON)	ICC	—	—	16.0	20.0	mA

6.2 Initial Code

```
void Initial_ic(void){

    Write_command_cs2(0xAE);    // turn off the display (AF=ON, AE=OFF)

    // Set Display Clock Divide Ratio/Oscillator Frequency
    Write_command_cs2(0xB3);
    Write_command_cs2(0x91);    // Set Clock as 135 Frames/Sec

    //Set Multiplex Ratio
    Write_command_cs2(0xA8);
    Write_command_cs2(0x3F);    // 1/64 Duty (0x0F~0x5F)

    // Set Display Offset
    Write_command_cs2(0xA2);
    Write_command_cs2(0x44);

    // Set Display Start Line
    Write_command_cs2(0xA1);
    Write_command_cs2(0x00);    // Set Mapping RAM Display Start Line (0x00~0x5F)

    // Set Re-Map
    Write_command_cs2(0xA1);
    Write_command_cs2(0XC8);

    // Set Master Configuration
    Write_command_cs2(0xAD);
    Write_command_cs2(0x02);    // Select external VCC supply

    //Set Biasing Current for DC/DC converter
    Write_command_cs2(0xCF);
    Write_command_cs2(0xF0);    // Not documented

    //Set Current Range
    Write_command_cs2(0x86);    // Set full Current Range

    // Set Contrast Current
    Write_command_cs2(0x81);
    Write_command_cs2(0x7F);    // full

    // Set Row Period / Frame Frequency
    Write_command_cs2(0xB2);
    Write_command_cs2(0x46);

    // Set Phase Length
    Write_command_cs2(0xB1);
    Write_command_cs2(0x22);

    // Set Pre-charge Voltage
    Write_command_cs2(0xBC);
```

```
        Write_command_cs2(0x10);

        // Set Pre-Charge Compensation
        Write_command_cs2(0xB4);   // Set Pre-Charge Compensation Level
        Write_command_cs2(0x02);   // Default => 0x00 (No Compensation)
        Write_command_cs2(0xB0);   // Set Pre-Charge Compensation Enable
        Write_command_cs2(0x28);   // Enable

        // Set VCOMH Voltage
        Write_command_cs2(0xBE);
        Write_command_cs2(0x02);

        // Set VSL
        Write_command_cs2(0xBF);
        Write_command_cs2(0x0D);

        // Set Display Mode
        Write_command_cs2(0xA4);   // Normal Display

        // Set Display On
        Write_command_cs2(0xAF);
}
```
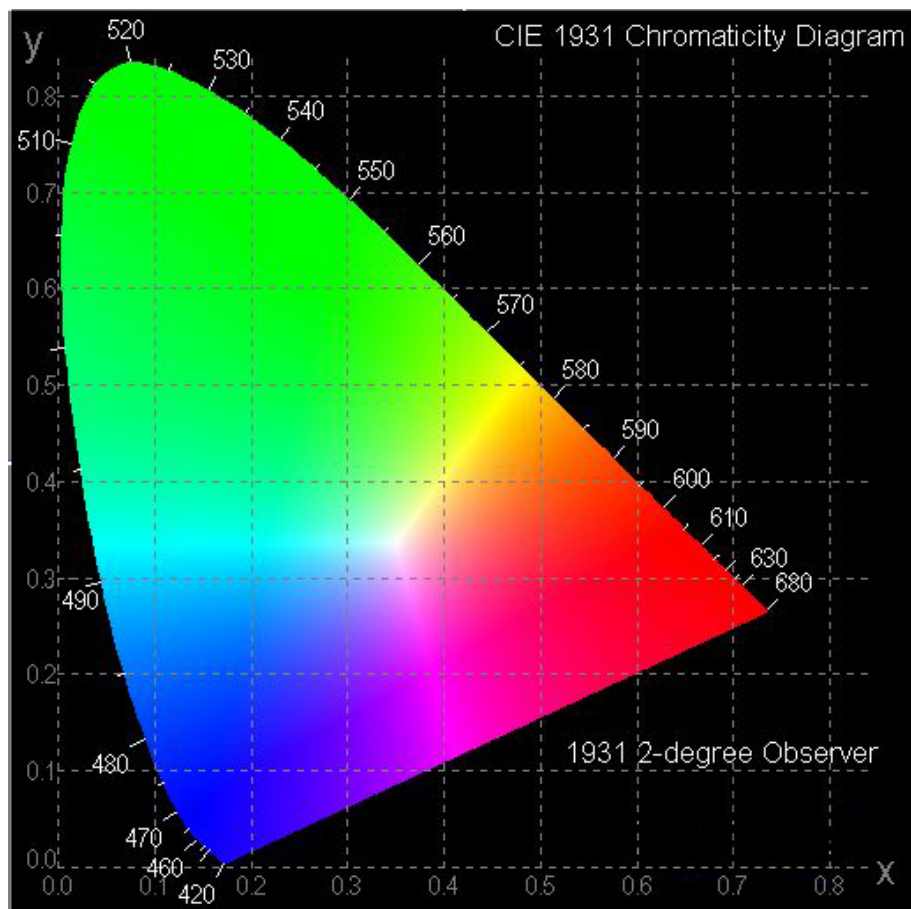
7.Optical Characteristics

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			60	80	—	cd/m2
CIEx(White)		(CIE1931)	0.26	0.28	0.30	—
CIEy(White)		(CIE1931)	0.30	0.32	0.34	—

8.OLED Lifetime

ITEM	Conditions	Min	Typ	Remark
Operating Life Time	Ta=25℃ / Initial 50% check board brightness Typical Value	20,000 Hrs	—	Note

Notes:
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.	85°C 240hrs	____
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-40°C 240hrs	____
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	80°C 240hrs	____
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-40°C 240hrs	____
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60°C,90%RH 240hrs	____
High Temperature/ Humidity Operation	Endurance test applying the high temperature and high humidity Operation for a long time.	60°C,90%RH 120hrs	____
Temperature Cycle	Endurance test applying the low and high temperature cycle. -40°C 25°C 80°C 30min 5min 30min 1 cycle	-40°C /80°C 30 cycles	____
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	Frequency:10~55Hz amplitude:1.5mm Time:0.5hrs/axis Test axis:X,Y,Z	____
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°C

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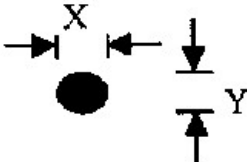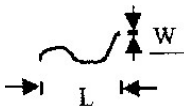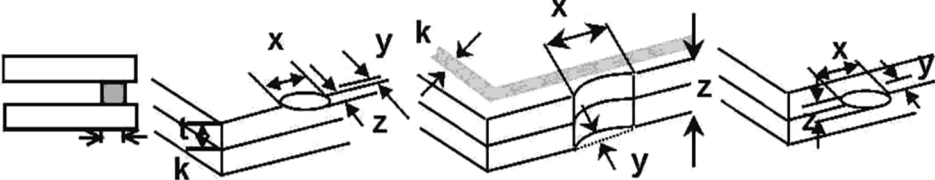
Evaluation criteria
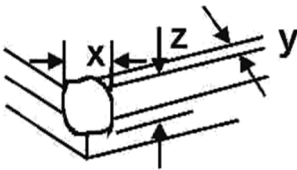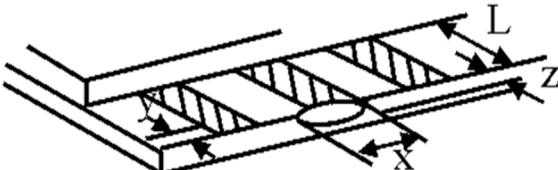
1. The function test is OK.
2. No observable defects.
3. Luminance: > 50% of initial value.
4. Current consumption: within ± 50% of initial value.
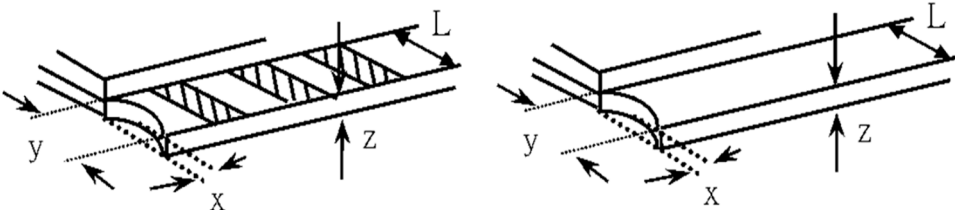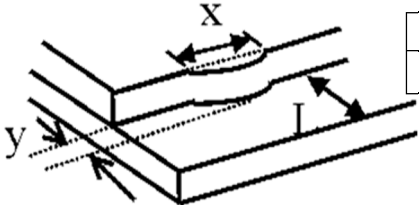
APPENDIX:

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.
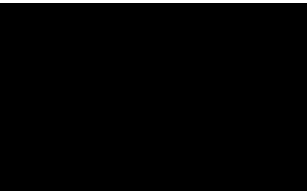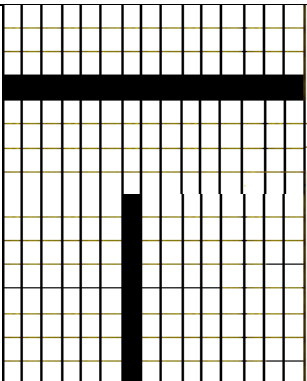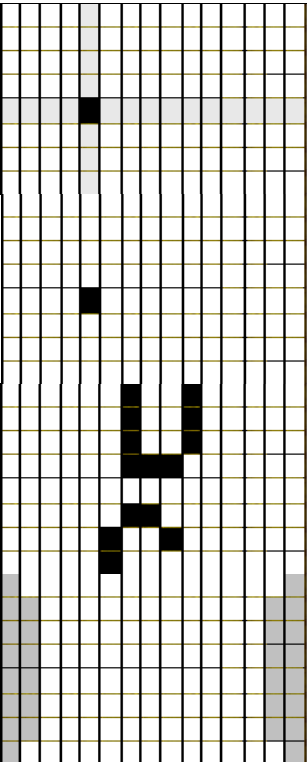
10.Inspection Specification

NO	Item	Criterion	AQL
01	Electrical Testing	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.	0.65
02	Black or white spots on OLED (display only)	2.1 White and black spots on display $\leqq$0.25mm, no more than three white or black spots present. 2.2 Densely spaced: No more than two spots or lines within 3mm.	2.5

03 OLED black spots, white spots, contamination (non-display)

3.1 Round type :
As following drawing
$\Phi=(x + y) / 2$

SIZE	Acceptable QTY
$\Phi\leqq0.10$	Accept no dense
$0.10<\Phi\leqq0.20$	2
$0.20<\Phi\leqq0.25$	1
$0.25<\Phi$	0

AQL: 2.5

3.2 Line type : (As following drawing)

Length	Width	Acceptable Q TY
---	W$\leqq$0.02	Accept no dense
L$\leqq$3.0	0.02$<$W$\leqq$0.03	2
L$\leqq$2.5	0.03$<$W$\leqq$0.05	
---	0.05$<$W	As round type

AQL: 2.5

NO	Item	Criterion		AQL
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.	Size Φ — Acceptable Q TY: $\Phi\leqq0.20$ — Accept no dense $0.20<\Phi\leqq0.50$ — 3 $0.50<\Phi\leqq1.00$ — 2 $1.00<\Phi$ — 0 Total Q TY — 3	2.5
05	Scratches	Follow NO.3 OLED black spots, white spots, contamination.		

NO	Item	Criterion	AQL
06	Chipped glass	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: 6.1.2 Corner crack: 	2.5

Chipped glass table (6.1.1):

z: Chip thickness	y: Chip width	x: Chip length
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$
$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$

⊙If there are 2 or more chips, x is total length of each chip.

Corner crack table (6.1.2):

z: Chip thickness	y: Chip width	x: Chip length
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$
$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$

⊙If there are 2 or more chips, x is the total length of each chip.

NO	Item	Criterion	AQL
	Glass crack	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 : 	2.5

Glass crack table (6.2.1):

y: Chip width	x: Chip length	z: Chip thickness
$y \leq 0.5mm$	$x \leq 1/8a$	$0 < z \leq t$

NO	Item	Criterion	AQL
06	Glass crack	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>	2.5
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

NO	Item	Criterion	AQL
10	PCB , COB	10.1 COB seal may not have pinholes larger than 0.2mm or contamination.	2.5
		10.2 COB seal surface may not have pinholes through to the IC.	2.5
		10.3 The height of the COB should not exceed the height indicated in the assembly diagram.	0.65
		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.	2.5
		10.5 No oxidation or contamination PCB terminals.	2.5
		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.	0.65
		10.7 The jumper on the PCB should conform to the product characteristic chart.	0.65
		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
11	Soldering	11.1 No un-melted solder paste may be present on the PCB.	2.5
		11.2 No cold solder joints, missing solder connections, oxidation or icicle.	2.5
		11.3 No residue or solder balls on PCB.	2.5
		11.4 No short circuits in components on PCB.	0.65
12	General appearance	12.1 No oxidation, contamination, curves or, bends on interface Pin (OLB) of TCP.	2.5
		12.2 No cracks on interface pin (OLB) of TCP.	0.65
		12.3 No contamination, solder residue or solder balls on product.	2.5
		12.4 The IC on the TCP may not be damaged, circuits.	2.5
		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.	2.5
		12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color.	2.5
		12.7 Sealant on top of the ITO circuit has not hardened.	2.5
		12.8 Pin type must match type in specification sheet.	0.65
		12.9 OLED pin loose or missing pins.	0.65
		12.10 Product packaging must the same as specified on packaging specification sheet.	0.65
		12.11 Product dimension and structure must conform to product specification sheet.	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	A Normal B Dark Pixel C Light Pixel
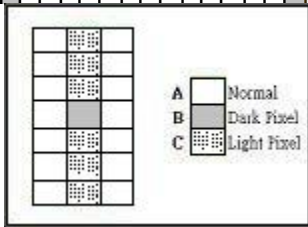
11.Precautions in Use of OLED Modules

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, modify its shape or change the components of OLED display module.

(3)Don't disassemble the OLED display module.

(4)Don't operate it above the absolute maximum rating.

(5)Don't drop, bend or twist OLED display module.

(6)Soldering: only to the I/O terminals.

(7)Storage: please store in anti-static electricity container and clean environment.

(8)Use a "Screen Saver" to extend the lifetime. Do not show fixed information for a long time in the application.

(9)Don't use fixed information in OLED panel for long time that will cause "screen burn" effect.

(10)The manufacturer has the right to change the passive components, including R2and R3 adjust resistors.   (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)

(11)The manufacturer has the right to change the PCB Rev. (In order to satisfy supply stability, management optimization, and the best product performance..., under the premise of not affecting the electrical characteristics and external dimensions. The manufacturer has the right to modify the version.)

11.1. Handling Precautions

(1) Since the display panel is made of glass, do not apply mechanical impacts such us 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 or ingest 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, 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. Please be careful when handling the OLED display module.

(5) When the surface of the polarizer of the OLED display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
    * Scotch Mending Tape No. 810 or an equivalent
    Never try to breathe upon the soiled surface or 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 solvents can damage the polarizer:
    * Water
    * Ketone
    * Aromatic Solvents

(6) 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.
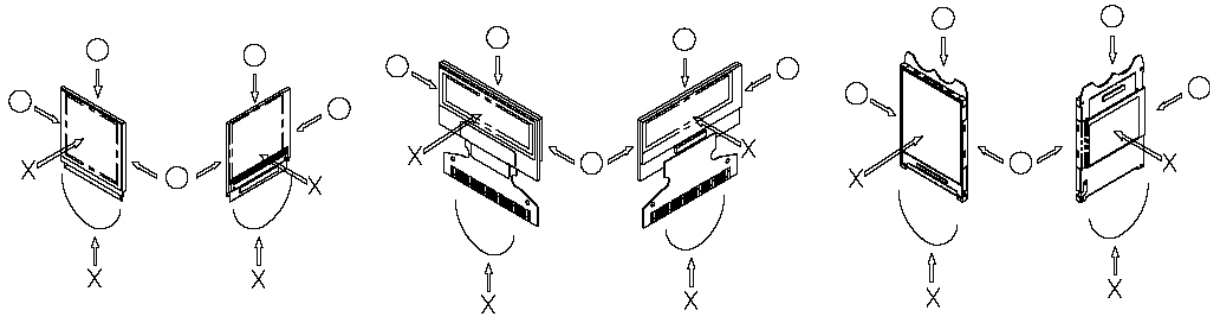
(7) Do not apply stress to the LSI chips and the surrounding molded sections.
(8) Do not disassemble or modify the OLED display module.
(9) Do not apply input signals while the logic power is off.
(10) Give sufficient attention to the working environments when handing OLED display
modules to prevent 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 removing the protective
film.
(11) Protective film is applied to the surface of the display panel.   Remove the
protective film before assembly.   If the OLED display module has been stored
for a long period of time, residue adhesive material from the protective film may remain on the
surface of the display panel after the film is removed. In such case, remove the residue
material by the method introduced in the above Section 5.
(12) If electric current is applied when the OLED display module has moisture condensation or
   when it is placed under high humidity environments, the electrodes may corrode.

11.2. Storage Precautions
(1) When storing OLED display modules, put them in static electricity preventive bags
avoiding exposure to direct sun light and fluorescent lamps.   Avoid high temperature and high
   humidity environment or low temperature (less than 0°C) environments.
(The manufacturer recommends storing these modules in the packaged state as they were
   shipped.)
At that time, be careful not to let water drops adhere to the packages or bags or let condensation
   occur with them.
(2) If electric current is applied when condensation is present or when it is placed under
high humidity environments, the electrodes may corrode.

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, panel damage may be happen.
(2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH
specifications and, at the same time, to make the signal line cable as short as possible.
(3) Excess current protection devices (fuses, etc.) are recommend on the power circuit (VDD).
   (Recommend value: 0.5A)
(4) Give sufficient attention to avoid occurrence of mutual noise interference with the
neighboring devices.
(5) For EMI, take necessary measures in the application equipment.
(6) When fastening the OLED display module, fasten the external plastic housing section.

(7) If power supply 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, the manufacturer cannot guarantee the quality of the OLED display module.
* Connection (contact) to any other potential than the above may lead to rupture of the IC.

11.4. Precautions when disposing of the OLED display modules
1) 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.

11.5. Other Precautions
(1) When an OLED display module is operated for a long time with a fixed pattern, the pattern may remain as an after image with slight contrast or brightness variation.
Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.
(2) To protect OLED display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the OLED display modules.
* Pins and electrodes
* Pattern layouts such as the TCP & FPC
(3) With this OLED display module, the OLED driver is exposed. Generally, semiconductor elements change their characteristics when exposed to light, similar to the principle of the solar battery. Consequently, if this OLED driver is exposed to light, malfunctioning may occur.
* Design the product and installation method so that the OLED driver may be shielded from light in actual usage.
* Design the product and installation method so that the OLED driver may be shielded from light during the inspection processes.
(4) Although this OLED display module stores the operational state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal states may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
(5) The manufacturer recommends periodic refreshment of the operation status (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.
(6) Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.
(7) The manufacturer has the right to upgrade and modify the product function.
(8) The limitation of FPC and Film bending.
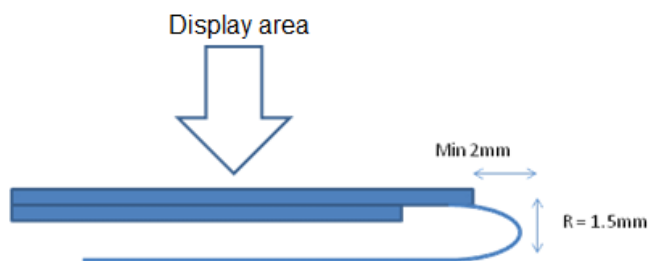
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