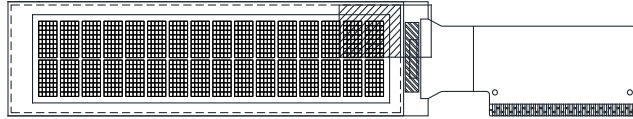


16 x 2 Character OLED



FEATURES

- Type: character
- Display format: 16 x 2 characters
- Built-in controller: OLED-0010
- Duty cycle: 1/16
- +3 V power supply
- Interface: SSD1311
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

MECHANICAL DATA		
ITEM	STANDARD VALUE	UNIT
Module dimension	68.5 x 17.5 x 2.05	mm
Viewing area	58.22 x 13.52	
Active area	56.22 x 11.52	
Dot size	0.57 x 0.67	
Dot pitch	0.60 x 0.70	
Mounting hole	n/a	
Character size	2.97 x 5.57	
Character pitch	3.55 x 5.95	

ABSOLUTE MAXIMUM RATINGS				
ITEM	SYMBOL	STANDARD VALUE		UNIT
		MIN.	MAX.	
Supply voltage for logic	$V_{DDI/O}$	-0.3	3.6	V
Operating temperature	T_{OP}	-40	+80	°C
Storage temperature	T_{STG}	-40	+80	

ELECTRICAL CHARACTERISTICS						
ITEM	SYMBOL	CONDITION	STANDARD VALUE			UNIT
			MIN.	TYP.	MAX.	
Supply voltage for logic	$V_{DDI/O}$	-	2.8	3.0	3.3	V
Supply voltage for display	V_{CC}	-	10	12	15	
Input high voltage	V_{IH}	-	0.8 V_{DD}	-	-	
Input low voltage	V_{IL}	-	-	-	0.2 V_{DD}	
Output high voltage	V_{OH}	$I_{OH} = -0.5 \text{ mA}$	0.9 V_{DD}	-	-	
Output low voltage	V_{OL}	$I_{OL} = 0.5 \text{ mA}$	-	-	0.1 V_{DD}	
50 % check board operating current	I_{CC}	$V_{CC} = 12 \text{ V}$	9	10	12	mA

Note

- When you use 3.3 V for logic, the user device must satisfy: MCU (pic 24 or higher); power supply cannot be less than 3.3 V (battery driven not recommended)

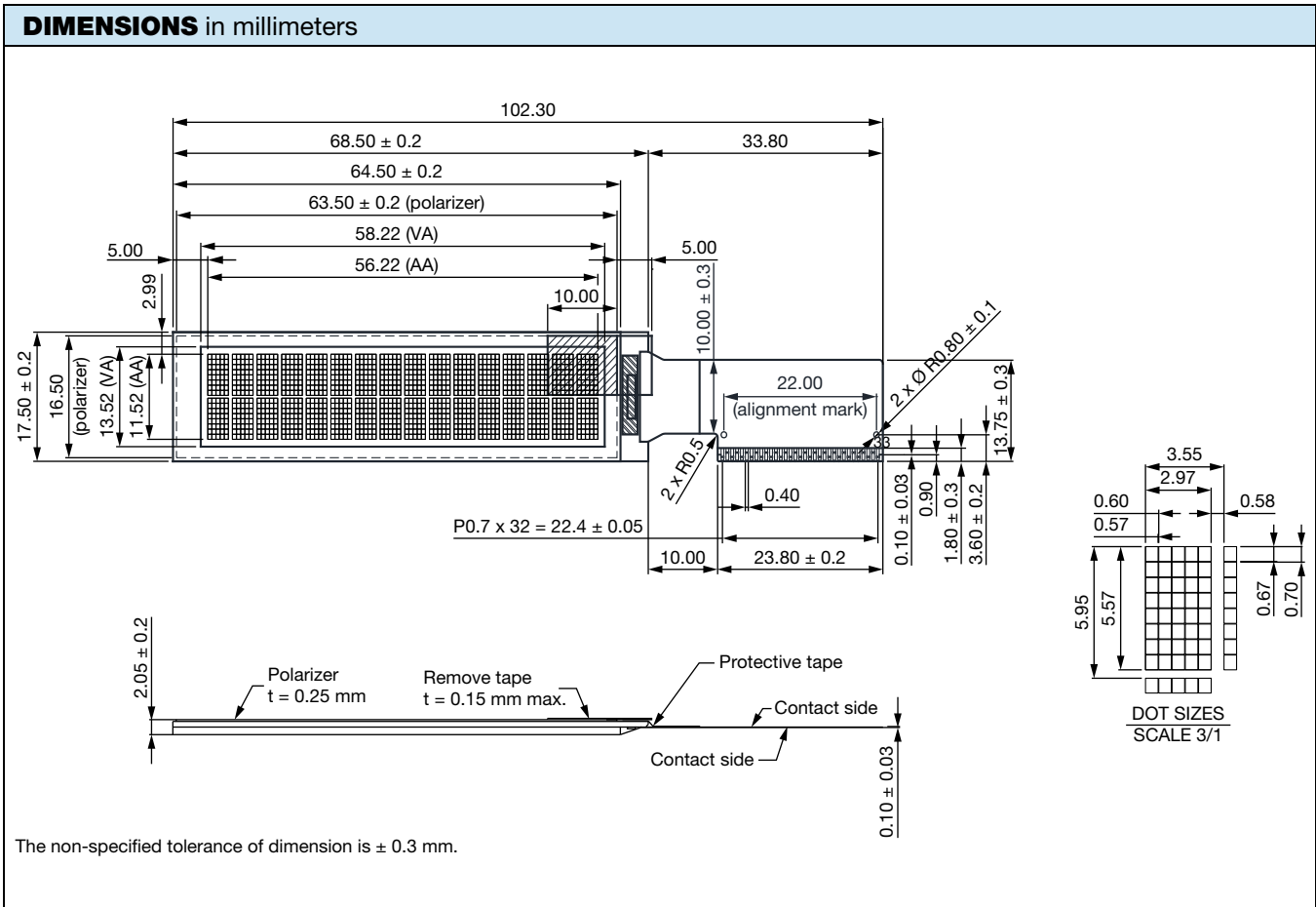
OPTIONS									
EMITTING COLOR					MOQ				
YELLOW	GREEN	RED	BLUE	WHITE	YELLOW	GREEN	RED	BLUE	WHITE
-	-	-	Yes	-	-	-	-	Yes	-



INTERFACE PIN FUNCTION																					
PIN NO.	SYMBOL	PIN TYPE	DESCRIPTION																		
1	NC	-	No connection																		
2	V _{SL}	P	This is segment voltage (output low level) reference pin. When external V _{SL} is not used, this pin should be left open. When external V _{SL} is used, connect with resistor and diode to ground (details depend on application).																		
3	V _{SS}	P	Ground pin. It must be connected to external ground.																		
4	REG V _{DD}	I	Internal V _{DD} regulator selection pin in 5 V I/O application mode. When this pin is pulled “high”, internal V _{DD} regulator is enabled (5 V I/O application). When this pin is pulled “low”, internal V _{DD} regulator is disabled (low voltage I/O application).																		
5	SHLC	I	<p>This pin is used to determine the common output scanning direction. COM scan direction</p> <table border="1"> <tr> <td>SHLC</td> <td>COM scan direction</td> </tr> <tr> <td>0</td> <td>COM0 to COM31 (normal)</td> </tr> <tr> <td>1</td> <td>COM31 to COM0 (reverse)</td> </tr> </table> <p>Notes</p> <ul style="list-style-type: none"> • 0 is connected to V_{SS} • 1 is connected to V_{DDI/O} 	SHLC	COM scan direction	0	COM0 to COM31 (normal)	1	COM31 to COM0 (reverse)												
SHLC	COM scan direction																				
0	COM0 to COM31 (normal)																				
1	COM31 to COM0 (reverse)																				
6	SHLS	I	<p>This pin is used to change the mapping between the display data column address and the segment driver. SEG scan direction</p> <table border="1"> <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> <p>Notes</p> <ul style="list-style-type: none"> • 0 is connected to V_{SS} • 1 is connected to V_{DDI/O} 	SHLS	SEG direction	1	SEG0 to SEG99 (normal)	0	SEG99 to SEG0 (reverse)												
SHLS	SEG direction																				
1	SEG0 to SEG99 (normal)																				
0	SEG99 to SEG0 (reverse)																				
7	V _{DD}	P	Power supply for core logic operation. V _{DD} can be supplied externally or regulated internally. In LV I/O application (internal V _{DD} is disabled), this is a power input pin. In 5 V I/O application (internal V _{DD} is enabled), V _{DD} is regulated internally from V _{DDI/O} . A capacitor should be connected between V _{DD} and V _{SS} under all circumstances.																		
8	V _{DDI/O}	P	Low voltage power supply and power supply for interface logic level in both low voltage I/O and 5 V I/O application. It should match with the MCU interface voltage level and must be connected to external source.																		
9	BS0	I	<p>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.</p> <table border="1"> <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 6800 parallel</td> </tr> <tr> <td>111</td> <td>4-bit 6800 parallel</td> </tr> </table> <p>Notes</p> <ul style="list-style-type: none"> • 0 is connected to V_{SS} • 1 is connected to V_{DDI/O} 	BS [2:0]	Interface	000	Serial interface	001	Invalid	010	I ² C	011	Invalid	100	8-bit 6800 parallel	101	4-bit 6800 parallel	110	8-bit 6800 parallel	111	4-bit 6800 parallel
BS [2:0]	Interface																				
000	Serial interface																				
001	Invalid																				
010	I ² C																				
011	Invalid																				
100	8-bit 6800 parallel																				
101	4-bit 6800 parallel																				
110	8-bit 6800 parallel																				
111	4-bit 6800 parallel																				
10	BS1																				
11	BS2																				
12	GPIO	I/O	It is a GPIO pin. Details refer to OLED command DCh.																		
13	CS#	I	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 I ² C mode, this pin must be connected to V _{SS} .																		
14	RES#	I	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.																		



INTERFACE PIN FUNCTION																							
PIN NO.	SYMBOL	PIN TYPE	DESCRIPTION																				
15	D / C#	I	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 I ² C mode, this pin acts as SA0 for slave address selection. When serial interface is selected, this pin must be connected to V _{SS} .																				
16	R / W# (WR#)	I	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 I ² C interface is selected, this pin must be connected to V _{SS} .																				
17	E (RD#)	I	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 I ² C interface is selected, this pin must be connected to V _{SS} .																				
18	D0	I/O	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 I ² C mode is selected, D2, D1 should be tied together and serve as SDA _{out} , SDA _{in} in application and D0 is the serial clock input, SCL.																				
19	D1																						
20	D2																						
21	D3																						
22	D4																						
23	D5																						
24	D6																						
25	D7																						
26	IREF	I	This pin is the segment output current reference pin. IREF is supplied externally. A resistor should be connected between this pin and V _{SS} to maintain current of around 15 μA																				
27	ROM0	I	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 border="1" style="margin-left: 20px;"> <thead> <tr> <th>ROM1</th> <th>ROM0</th> <th>ROM</th> </tr> </thead> <tbody> <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</td> </tr> </tbody> </table>	ROM1	ROM0	ROM	0	0	A	0	1	B	1	0	C	1	1	S / W selectable					
ROM1	ROM0			ROM																			
0	0	A																					
0	1	B																					
1	0	C																					
1	1	S / W selectable																					
28	ROM1	Notes <ul style="list-style-type: none"> • 0 is connected to V_{SS} • 1 is connected to V_{DDI/O} 																					
29	OPR0	I	This pin is used to select the character number of character generator. Character RAM selection <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>OPR1</th> <th>OPR0</th> <th>CGROM</th> <th>CGRAM</th> </tr> </thead> <tbody> <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> </tbody> </table>	OPR1	OPR0	CGROM	CGRAM	1	1	256	0	0	1	248	8	1	0	250	6	0	0	240	8
OPR1	OPR0			CGROM	CGRAM																		
1	1	256	0																				
0	1	248	8																				
1	0	250	6																				
0	0	240	8																				
30	OPR1	Notes <ul style="list-style-type: none"> • 0 is connected to V_{SS} • 1 is connected to V_{DDI/O} 																					
31	VCOMH	P	COM signal deselected voltage level. A capacitor should be connected between this pin and V _{SS} . No external power supply is allowed to connect to this pin.																				
32	V _{CC}	P	Power supply for panel driving voltage. This is also the most positive power voltage supply pin. It is supplied by external high voltage source.																				
33	NC	-	No connection																				





1.Module Classification Information

OLED 016 O 002 C S P P 3 N 0 0 000
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

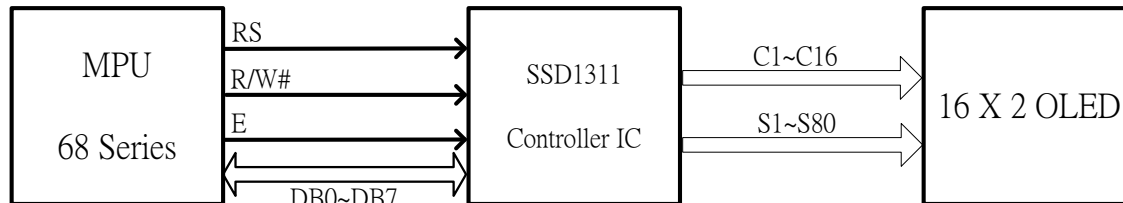
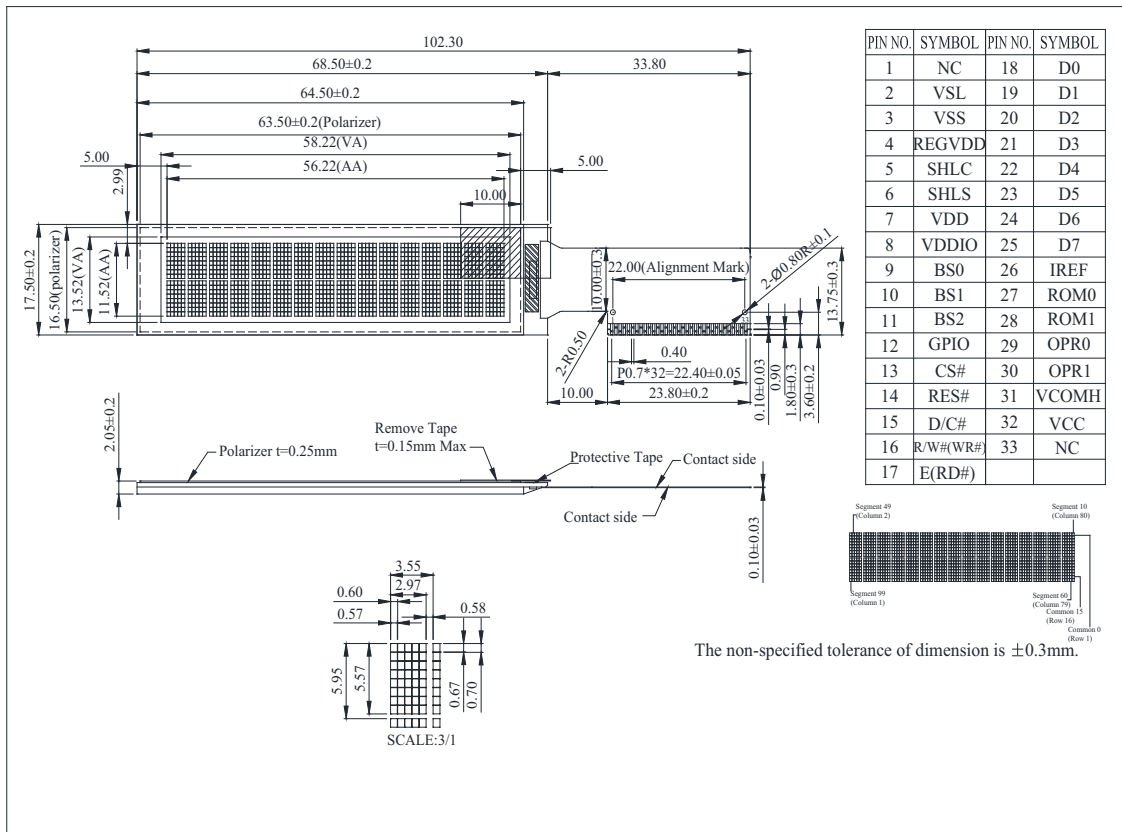
1	Brand: Vishay Intertechnology, Inc.		
2	Horizontal Format: 16 Columns		
3	Display Type: N→Character Type, H→Graphic Type, Y→Tab Type, O→Cog		
4	Vertical Format: 2 Lines		
5	Serials code		
6	Emitting Color	A : Amber	R : RED
		B : Blue	W : White
		G : Green	L : Yellow
		S : Sky Blue	
7	Polarizer	P : With Polarizer; N: Without Polarizer A : Anti-glare Polarizer	
8	Display Mode	P : Passive Matrix ; A: Active Matrix	
9	Driver Voltage	3: 3.0 V; 5: 5.0V	
10	Touch Panel	N : Without touch panel; T: With touch panel	
11	Products type	0 : Standard type 1. Sunlight Readable type 2. Transparent OLED (TOLED) 3. Flexible OLED 4. OLED for Lighting	
12	Product grades	Product grades: 0 : Standard(A-level) 2 : B-level 3 : C-level 4 : high class(AA-level) 5 : Customer offerings Y : Consumer product	
13	Serial No.	Application serial number(000~ZZZ)	



2.General Specification

Item	Dimension	Unit
Number of Characters	16 characters x 2 Lines	—
Module dimension	68.5 x 17.5 x 2.05	mm
View area	58.22 x 13.52	mm
Active area	56.22 x 11.52	mm
Dot size	0.57 x 0.67	mm
Dot pitch	0.60 x 0.70	mm
Character size	2.97 x 5.57	mm
Character pitch	3.55 x 5.95	mm
Panel type	OLED , Sky Blue	
Duty	1/16	
IC	SSD1311	

3. Contour Drawing & Block Diagram



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

4. Interface Pin Function

Pin No.	Symbol	Pin Type	Description	
1	NC	—	No connection	
2	VSL	P	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).	
3	VSS	P	Ground pin. It must be connected to external ground.	
4	REGVDD	I	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).	
5	SHLC	I	This pin is used to determine the Common output scanning direction. COM scan direction	
			SHLC	COM scan direction
			1	COM0 to COM31 (Normal)
			0	COM31 to COM0 (Reverse)
			Note (1) 0 is connected to VSS (2) 1 is connected to VDDIO	
6	SHLS	I	This pin is used to change the mapping between the display data column address and the Segment driver. SEG scan direction	
			SHLS	SEG direction
			1	SEG0 to SEG99 (Normal)
			0	SEG99 to SEG0 (Reverse)
			Note (1) 0 is connected to VSS (2) 1 is connected to VDDIO	
7	VDD	P	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.	
8	VDDIO	P	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.	
9	BS0	I	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	
10	BS1			



11	BS2		BS[2:0]	Interface
			000	Serial Interface
			001	Invalid
			010	I ² C
			011	Invalid
			100	8-bit 6800 parallel
			101	4-bit 6800 parallel
			110	8-bit 8080 parallel
			111	4-bit 8080 parallel
Note				
(1) 0 is connected to VSS				
(2) 1 is connected to VDDIO				
12	GPIO	I/O	It is a GPIO pin. Details refer to OLED command DCh.	
13	CS#	I	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.	
14	RES#	I	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.	
15	D/C#	I	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.	
16	R/W#(WR#)	I	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.	
17	E(RD#)	I	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.	
18	D0	I/O	These pins are bi-directional data bus connecting to the MCU data bus.	
19	D1		Unused pins are recommended to tie LOW.	



20	D2		<p>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.</p> <p>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.</p>																				
21	D3																						
22	D4																						
23	D5																						
24	D6																						
25	D7																						
26	IREF	I	<p>This pin is the segment output current reference pin. IREF is supplied externally.</p> <p>A resistor should be connected between this pin and VSS to maintain current of around 15uA.</p>																				
27	ROM0	I	<p>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:</p> <p>Character ROM selection</p> <table border="1"> <thead> <tr> <th>ROM1</th> <th>ROM0</th> <th>ROM</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Note (1) 0 is connected to VSS (2) 1 is connected to VDDIO</p>	ROM1	ROM0	ROM	0	0	A	0	1	B	1	0	C	1	1	S/W selectable ⁽³⁾					
ROM1	ROM0			ROM																			
0	0	A																					
0	1	B																					
1	0	C																					
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28	ROM1																						
29	OPR0	I	<p>This pin is used to select the character number of character generator. Character RAM selection</p> <table border="1"> <thead> <tr> <th>OPR1</th> <th>OPR0</th> <th>CGROM</th> <th>CGRAM</th> </tr> </thead> <tbody> <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> </tbody> </table> <p>Note (1) 0 is connected to VSS (2) 1 is connected to VDDIO</p>	OPR1	OPR0	CGROM	CGRAM	1	1	256	0	0	1	248	8	1	0	250	6	0	0	240	8
OPR1	OPR0			CGROM	CGRAM																		
1	1	256	0																				
0	1	248	8																				
1	0	250	6																				
0	0	240	8																				
30	OPR1																						
31	VCOMH	P	<p>COM signal deselected voltage level.</p> <p>A capacitor should be connected between this pin and VSS. No external power supply is allowed to connect to this pin.</p>																				
32	VCC	P	<p>Power supply for panel driving voltage. This is also the most positive power voltage supply pin. It is supplied by external high voltage source.</p>																				
33	NC	—	No connection																				



5. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Notes
Supply Voltage For Logic	VDDIO	-0.3	3.6	V	
Operating Temperature	T _{OP}	-40	+80	°C	
Storage Temperature	T _{ST}	-40	+80	°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 "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	—	2.8	3.0	3.3	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	9	10	12	mA

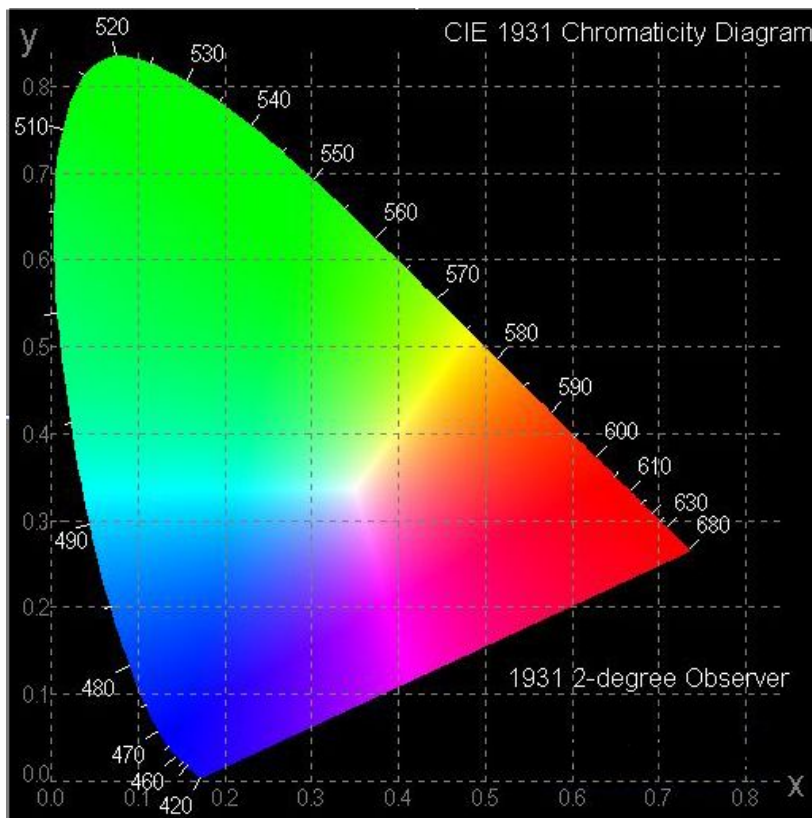
Note: When you use 3.3V for logic, the user device must satisfy:

MCU (pic 24 or higher)

Power supply cannot be less than 3.3V (battery driven not recommended)

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		μ s
	T fall	—		10		μ s
Display with 50% check Board Brightness			90	110		cd/m ²
CIEx(Sky blue)		(CIE1931)	0.12	0.16	0.20	
CIEy(Sky blue)		(CIE1931)	0.22	0.26	0.30	





8.OLED Lifetime

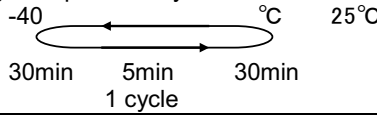
ITEM	Conditions	Min	Typ	Remark
Operating Life Time	Ta=25°C / Initial 50% check board brightness Typical Value	20,000 Hrs	—	Note

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.	80 °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	—
Temperature Cycle	Endurance test applying the low and high temperature cycle. 	-40 °C, 80°C 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=±600V(contact), ±800v(air), RS=330 Ω CS=150pF 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 $23\pm 5^{\circ}\text{C}$; $55\pm 15\%$ 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

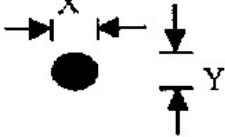
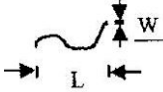
1. The function test is OK.
2. No observable defects.
3. Luminance: $> 50\%$ of initial value.
4. Current consumption: within $\pm 50\%$ of initial value.

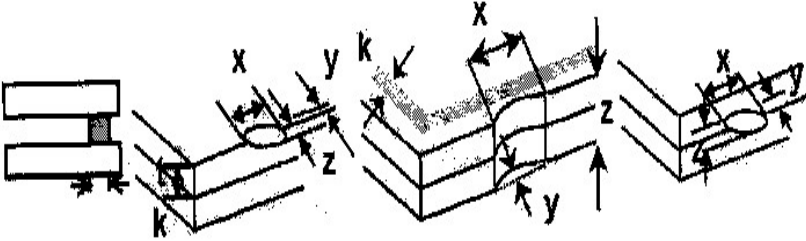
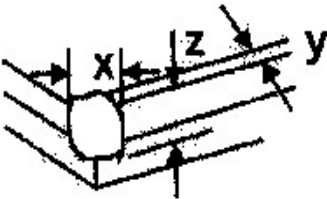
APPENDIX:

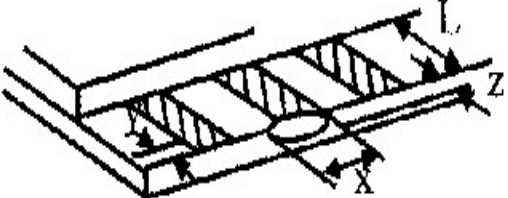
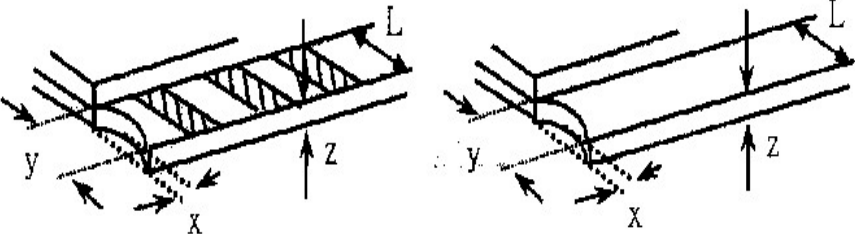
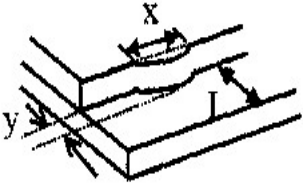
RESIDUE IMAGE

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 $\leq 0.25\text{mm}$, 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 $\Phi = (x + y) / 2$  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>SIZE</th> <th>Acceptable Q TY</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.10$</td> <td>Accept no dense</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.20$</td> <td>2</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	SIZE	Acceptable Q TY	$\Phi \leq 0.10$	Accept no dense	$0.10 < \Phi \leq 0.20$	2	$0.20 < \Phi \leq 0.25$	1	$0.25 < \Phi$	0	2.5				
SIZE	Acceptable Q TY																
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$0.10 < \Phi \leq 0.20$	2																
$0.20 < \Phi \leq 0.25$	1																
$0.25 < \Phi$	0																
		3.2 Line type : (As following drawing)  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acceptable Q TY</th> </tr> </thead> <tbody> <tr> <td>---</td> <td>$W \leq 0.02$</td> <td>Accept no dense</td> </tr> <tr> <td>$L \leq 3.0$</td> <td>$0.02 < W \leq 0.03$</td> <td rowspan="2">2</td> </tr> <tr> <td>$L \leq 2.5$</td> <td>$0.03 < W \leq 0.05$</td> </tr> <tr> <td>---</td> <td>$0.05 < W$</td> <td>As round type</td> </tr> </tbody> </table>	Length	Width	Acceptable Q TY	---	$W \leq 0.02$	Accept no dense	$L \leq 3.0$	$0.02 < W \leq 0.03$	2	$L \leq 2.5$	$0.03 < W \leq 0.05$	---	$0.05 < W$	As round type	2.5
Length	Width	Acceptable Q TY															
---	$W \leq 0.02$	Accept no dense															
$L \leq 3.0$	$0.02 < W \leq 0.03$	2															
$L \leq 2.5$	$0.03 < W \leq 0.05$																
---	$0.05 < W$	As round type															
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Size Φ</th> <th>Acceptable Q TY</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.20$</td> <td>Accept no dense</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.50$</td> <td>3</td> </tr> <tr> <td>$0.50 < \Phi \leq 1.00$</td> <td>2</td> </tr> <tr> <td>$1.00 < \Phi$</td> <td>0</td> </tr> <tr> <td>Total Q TY</td> <td>3</td> </tr> </tbody> </table>	Size Φ	Acceptable Q TY	$\Phi \leq 0.20$	Accept no dense	$0.20 < \Phi \leq 0.50$	3	$0.50 < \Phi \leq 1.00$	2	$1.00 < \Phi$	0	Total Q TY	3	2.5		
Size Φ	Acceptable Q TY																
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$1.00 < \Phi$	0																
Total Q TY	3																

NO	Item	Criterion	AQL																		
05	Scratches	Follow NO.3 OLED black spots, white spots, contamination																			
06	Chipped glass	<p>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:</p> <p>6.1 General glass chip : 6.1.1 Chip on panel surface and crack between panels:</p>  <table border="1" data-bbox="396 814 1206 953"> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td>$Z \leq 1/2t$</td> <td>Not over viewing area</td> <td>$x \leq 1/8a$</td> </tr> <tr> <td>$1/2t < z \leq 2t$</td> <td>Not exceed 1/3k</td> <td>$x \leq 1/8a$</td> </tr> </table> <p>⊙ If there are 2 or more chips, x is total length of each chip.</p> <p>6.1.2 Corner crack:</p>  <table border="1" data-bbox="396 1291 1206 1430"> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td>$Z \leq 1/2t$</td> <td>Not over viewing area</td> <td>$x \leq 1/8a$</td> </tr> <tr> <td>$1/2t < z \leq 2t$</td> <td>Not exceed 1/3k</td> <td>$x \leq 1/8a$</td> </tr> </table> <p>⊙ If there are 2 or more chips, x is the total length of each chip.</p>	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	$x \leq 1/8a$	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	$x \leq 1/8a$	2.5
z: Chip thickness	y: Chip width	x: Chip length																			
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$																			
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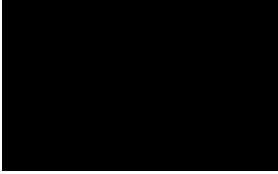
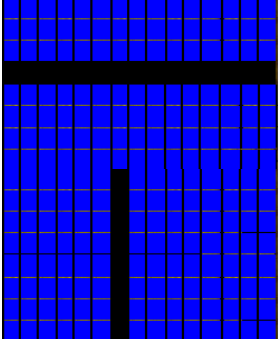
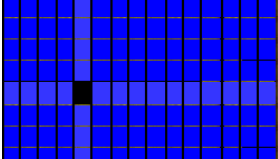
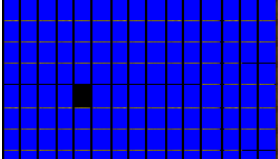
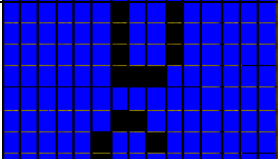
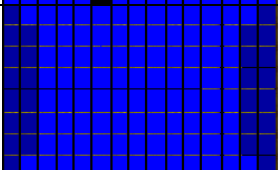
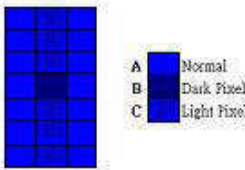
NO	Item	Criterion	AQL																
06	Glass crack	<p>Symbols :</p> <p>x: Chip length y: Chip width z: Chip thickness k: Seal width t: Glass thickness a: OLED side length L: Electrode pad length</p> <p>6.2 Protrusion over terminal :</p> <p>6.2.1 Chip on electrode pad :</p>  <table border="1" data-bbox="332 720 1140 793"> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td>$y \leq 0.5\text{mm}$</td> <td>$x \leq 1/8a$</td> <td>$0 < z \leq t$</td> </tr> </table> <p>6.2.2 Non-conductive portion:</p>  <table border="1" data-bbox="391 1087 1140 1192"> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td>$y \leq L$</td> <td>$x \leq 1/8a$</td> <td>$0 < z \leq t$</td> </tr> </table> <ul style="list-style-type: none"> ⊙ 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. <p>6.2.3 Substrate protuberance and internal crack.</p>  <table border="1" data-bbox="691 1413 1144 1486"> <tr> <td>y: width</td> <td>x: length</td> </tr> <tr> <td>$y \leq 1/3L$</td> <td>$x \leq a$</td> </tr> </table>	y: Chip width	x: Chip length	z: Chip thickness	$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$	y: Chip width	x: Chip length	z: Chip thickness	$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$	y: width	x: length	$y \leq 1/3L$	$x \leq a$	2.5
y: Chip width	x: Chip length	z: Chip thickness																	
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$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$																	
y: width	x: length																		
$y \leq 1/3L$	$x \leq a$																		



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.	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.	0.65
		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 $B/A \times 100\% < 70\%$ $A/C \times 100\% < 70\%$	Major	 <div style="display: flex; align-items: center; margin-top: 5px;">  </div>



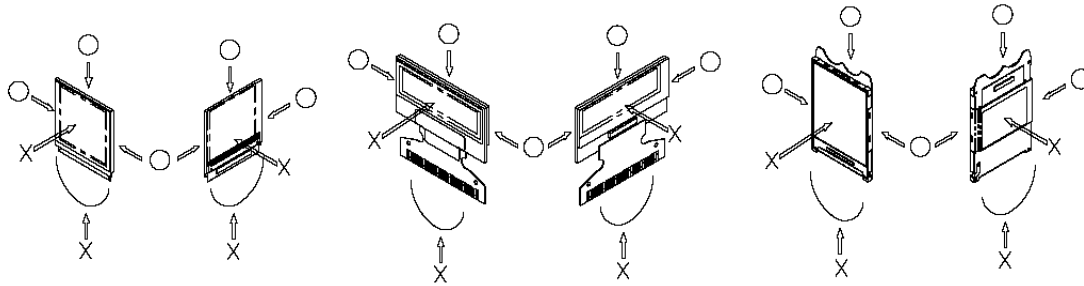
11. Precautions in use of OLED Modules

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 storage in anti-static electricity container and clean environment.
- (8) It's pretty common to use "Screen Saver" to extend the lifetime and Don't use fix information for long time in real application.
- (9) Don't use fixed information in OLED panel for long time, that will extend "screen burn" effect time..
- (10) Vishay has the right to change the passive components, including R2 and R3 adjust resistors. (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)
- (11) Vishay have the right to 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, Vishay have the right to modify the version.)

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 and 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 equivalentNever 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) 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 nor modify the OLED display module.
- (9) Do not apply input signals while the logic power is off.
- (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) 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.
- (12) If electric current is applied when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above.

11.2. Storage Precautions

- (1) When storing OLED display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high humidity environment or low temperature (less than 0°C) environments.
(We recommend you to store these modules in the packaged state when they were shipped from Vishay.
At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.
- (2) If electric current is applied when water drops are adhering to the surface of the OLED display module, when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

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) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)
- (4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
- (5) As for EMI, take necessary measures on the equipment side basically.



- (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, 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.

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 of time with fixed pattern may remain as an after image or slight contrast deviation may occur.

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 being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according 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 operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status 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) We recommend you to construct its software 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.

- (6)Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.

- (7)Our company will has the right to upgrade and modify the product function.



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