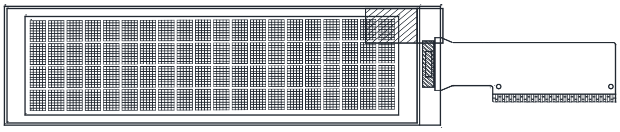
20 x 4 Character OLED



FEATURES

- Type: character
- Display format: 20 x 2 characters
- Built-in controller: SSD1311
- Duty cycle: 1/32
- +5 V power supply
- Interface: 6800
- With polarizer
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS
COMPLIANT

MECHANICAL DATA		
ITEM	**STANDARD VALUE**	**UNIT**
Module dimension	84.5 x 27.5 x 2.17	mm
Viewing area	72.42 x 22.82	
Active area	70.42 x 20.82	
Dot size	0.57 x 0.57	
Dot pitch	0.60 x 0.60	
Mounting hole	n/a	
Character size	2.97 x 4.77	
Character pitch	3.55 x 5.35	

ABSOLUTE MAXIMUM RATINGS				
ITEM	**SYMBOL**	**STANDARD VALUE**		**UNIT**
		MIN.	**MAX.**	
Supply voltage for logic	V_{DD} to V_{SS}	-0.3	6.0	V
Input voltage	V_I	-0.3	V_{DD}	V
Operating temperature	T_{OP}	-40	+80	°C
Storage temperature	T_{STG}	-40	+80	

Notes

- All the above voltages are on the basis of “V_{SS} = 0 V”
- 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 “Electrical Characteristics”. If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate

ELECTRICAL CHARACTERISTICS						
ITEM	**SYMBOL**	**CONDITION**	**STANDARD VALUE**			**UNIT**
			MIN.	**TYP.**	**MAX.**	
Supply voltage for logic	V_{DD} to V_{SS}	-	4.8	5.0	5.3	V
Supply voltage for display	V_{CC}	-	9	10	11	
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 mA	0.9 V_{DD}	-	-	
Output low voltage	V_{OL}	I_{OL} = 0.5 mA	-	-	0.1 V_{DD}	
50 % check board operating current	I_{CC}	V_{CC} = 10 V	17	19	21	mA

Note

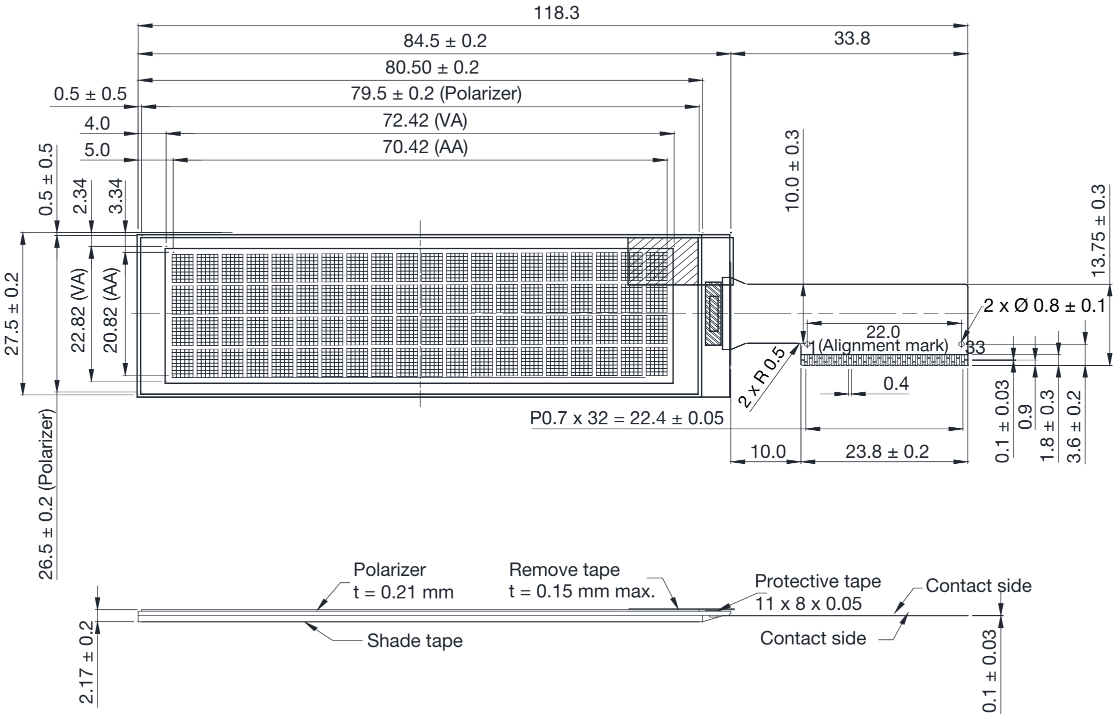
- When you use 5 V for V_{DD} please do not use 3 V or 3.3 V for logic I/O this will cause module does not work

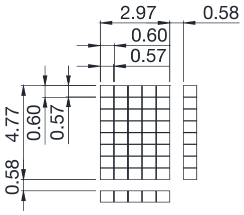
OPTIONS				
EMITTING COLOR				
YELLOW	**GREEN**	**RED**	**BLUE**	**WHITE**
Yes	-	-	-	-

<table>
<tr><th colspan="4">INTERFACE PIN FUNCTION</th></tr>
<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>V_{SL}</td><td>P</td><td>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).</td></tr>
<tr><td>3</td><td>V_{SS}</td><td>P</td><td>Ground pin. It must be connected to external ground.</td></tr>
<tr><td>4</td><td>REG V_{DD}</td><td>I</td><td>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).</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>0</td><td>COM0 to COM31 (normal)</td></tr>
<tr><td>1</td><td>COM31 to COM0 (reverse)</td></tr>
</table>
Notes
• 0 is connected to V_{SS}
• 1 is connected to $V_{DDI/O}$</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>
Notes
• 0 is connected to V_{SS}
• 1 is connected to $V_{DDI/O}$</td></tr>
<tr><td>7</td><td>V_{DD}</td><td>P</td><td>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.</td></tr>
<tr><td>8</td><td>$V_{DDI/O}$</td><td>P</td><td>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.</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>I^2C</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>
Notes
• 0 is connected to V_{SS}
• 1 is connected to $V_{DDI/O}$</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 I^2C mode, this pin must be connected to V_{SS}.</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>
</table>

<table>
<tr><th colspan="4">INTERFACE PIN FUNCTION</th></tr>
<tr><th>PIN NO.</th><th>SYMBOL</th><th>PIN TYPE</th><th>DESCRIPTION</th></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 I^2C mode, this pin acts as SA0 for slave address selection. When serial interface is selected, this pin must be connected to V_{SS}.</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 I^2C interface is selected, this pin must be connected to V_{SS}.</td></tr>
<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 I^2C interface is selected, this pin must be connected to V_{SS}.</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 I^2C 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.</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>I_{REF}</td><td>I</td><td>This pin is the segment output current reference pin. I_{REF} is supplied externally. A resistor should be connected between this pin and V_{SS} to maintain current of around 15 μA.</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><td>ROM1</td><td>ROM0</td><td>ROM</td></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</td></tr>
</table>
Notes
• 0 is connected to V_{SS}
• 1 is connected to $V_{DDI/O}$</td></tr>
<tr><td>28</td><td>ROM1</td></tr>
<tr><td>29</td><td>OPR0</td><td rowspan="2">I</td><td rowspan="2">This pin is used to select the character number of character generator.
Character RAM selection
<table>
<tr><td>OPR1</td><td>OPR0</td><td>CGROM</td><td>CGRAM</td></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>
Notes
• 0 is connected to V_{SS}
• 1 is connected to $V_{DDI/O}$</td></tr>
<tr><td>30</td><td>OPR1</td></tr>
<tr><td>31</td><td>V_{COMH}</td><td>P</td><td>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.</td></tr>
<tr><td>32</td><td>V_{CC}</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>

DIMENSIONS in millimeters





SCALE: 3/1

The non-specified tolerance of dimension is ± 0.3 mm

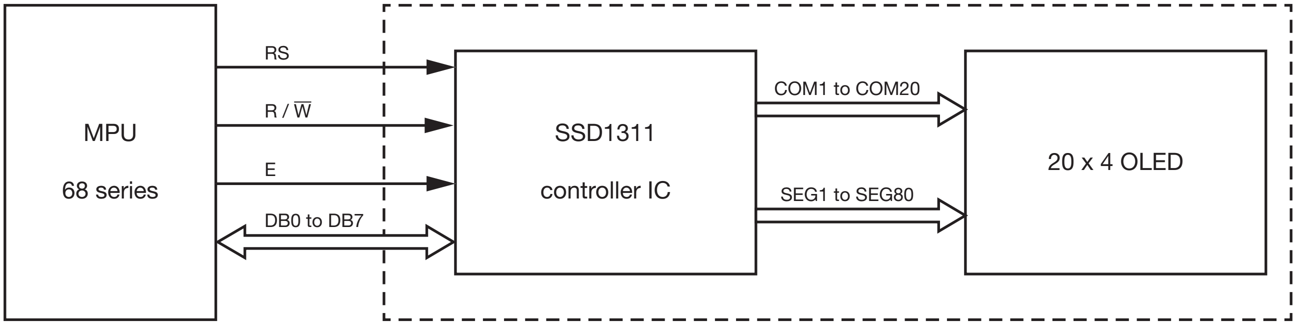
MODULE CLASSIFICATION INFORMATION

OLED	-	020	O	004	C	-	L	P	P	5	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	20 characters
3	Display type	H: graphic type N: character type O: COG type Y: tab type
4	Vertical format	4 lines
5	Serials code	C
6	Emitting color	A: amber B: blue C: full color G: green L: yellow R: red W: white Y: yellow green
7	Polarizer	N: without polarizer P: with polarizer
8	Display mode	A: active matrix P: passive matrix
9	Driver voltage	3: 3.0 V to 3.3 V 5: 5.0 V
10	Touch panel	N: without touch panel T: with touch panel
11	Products type	0: standard 1: sunlight readable 2: transparent OLED (TOLED) 3: flexible OLED 4: OLED for lighting
12	Product grades	0: standard (A level) 2: B level 3: C level 4: high class (AA level) 5: customer offerings
13	Serial number	Application serial number (000 to ZZZ)

GENERAL SPECIFICATIONS		
ITEM	**DIMENSION**	**UNIT**
Number of characters	20 characters x 4 lines	
Module dimension	84.5 x 27.5 x 2.17	mm
View area	72.42 x 22.82	mm
Active area	70.42 x 20.82	mm
Dot size	0.57 x 0.57	mm
Dot pitch	0.60 x 0.60	mm
Character size	2.97 x 4.77	mm
Character pitch	3.55 x 5.35	mm
Panel type	OLED, yellow	
Duty	1/32	
IC	SSD1311	

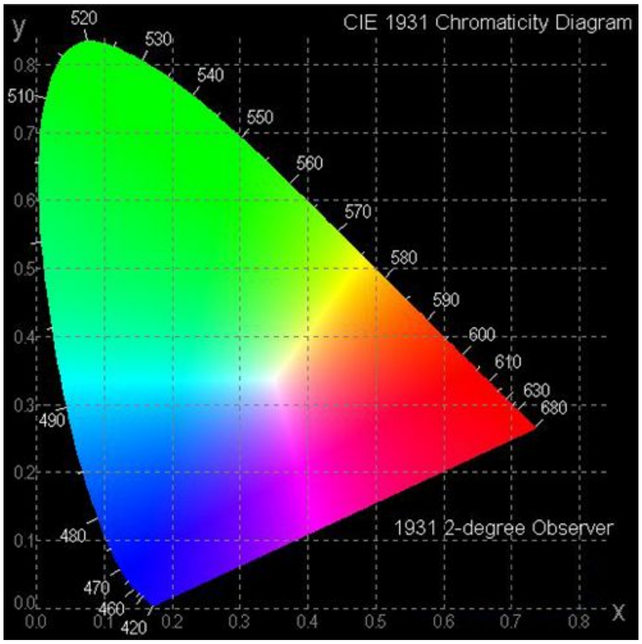
FUNCTION BLOCK DIAGRAM



Display position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DD RAM address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
DD RAM address	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	30	31	32	33
DD RAM address	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
DD RAM address	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	70	71	72	73

OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
View angle	(V)θ		160	-	-	deg
	(H)φ		160	-	-	
Contrast ratio	CR	Dark	2000 : 1	-	-	-
Response time	t_{rise}		-	10	-	μs
	t_{fall}		-	10	-	μs
Display with 50 % check board brightness			120	130	-	cd/m^2
CIE_x (yellow)	(CIE1931)		0.45	0.47	0.49	
CIE_y (yellow)	(CIE1931)		0.48	0.50	0.52	

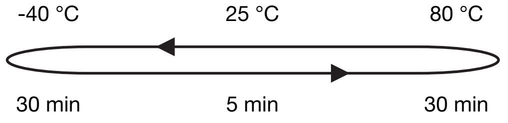


OLED LIFETIME

ITEM	CONDITIONS	MIN.	TYP.
Operating life time	T_A = 25 °C, initial 50 % check board brightness typical value	50 000 h	-

Notes

- Life time is defined the amount of time when the luminance has decayed to < 50 % of the initial value
- 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
- Screen saving mode will extend OLED lifetime

RELIABILITY		
ENVIRONMENTAL TEST		
TEST ITEM	**CONTENT OF TEST**	**TEST CONDITION**
High temperature storage	Endurance test applying the high storage temperature for a long time	80 °C, 240 h
Low temperature storage	Endurance test applying the low storage temperature for a long time	-40 °C, 240 h
High temperature operation	Endurance test applying the electric stress (voltage and current) and the thermal stress to the element for a long time	80 °C, 240 h
Low temperature operation	Endurance test applying the electric stress under low temperature for a long time	-40 °C, 240 h
High temperature / humidity storage	Endurance test applying the high temperature and high humidity storage for a long time	60 °C, 90 % RH, 240 h
Temperature cycle	Endurance test applying the low and high temperature cycle  -40 °C 25 °C 80 °C 30 min 5 min 30 min 1 cycle	-40 °C / 80 °C, 100 cycles
MECHANICAL TEST		
Vibration test	Endurance test applying the vibration during transportation and using	10 Hz to 22 Hz for 1.5 mm peak-to-peak, 22 Hz to 500 Hz for 1.5 *g*, total 0.5 h
Shock test	Constructional and mechanical endurance test applying the shock during transportation	50 *g* half sin wave 11 ms, 3 times of each direction
Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air	115 mbar, 40 h
OTHERS		
Static electricity test	Endurance test applying the electric stress to the terminal	V_S = ± 600 V (contact), ± 800 V (air), R_S = 330 Ω, C_S = 150 pF, 10 times

Note

- Supply voltage for OLED system = operating voltage at 25 °C

TEST AND MEASUREMENT CONDITIONS

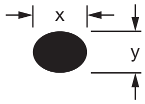
1. All measurements shall not be started until the specimens attain to temperature stability. After the completion of the described reliability test, the samples were left at room temperature for 2 hours prior to conducting the failure test at 23 °C ± 5 °C, 55 % ± 15 % RH
2. All-pixels-on is used as operation test pattern
3. The degradation of polarizer are ignored for high temperature storage, high temperature / humidity storage, temperature cycle

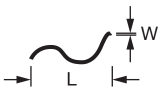
EVALUATION CRITERIA

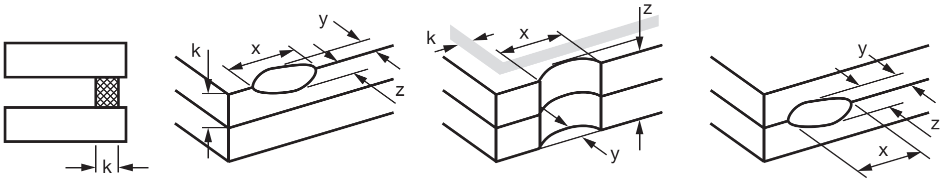
4. The function test is OK
5. No observable defects
6. Luminance: > 50 % of initial value
7. Current consumption: within ± 50 % of initial value

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.

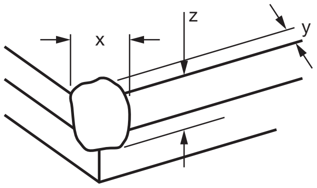
<table>
<tr><th colspan="4">INSPECTION SPECIFICATION</th></tr>
<tr><th>NO.</th><th>ITEM</th><th>CRITERION</th><th>AQL</th></tr>
<tr><td>01</td><td>Electrical testing</td><td>1.1 Missing vertical, horizontal segment, segment contrast defect
1.2 Missing character, dot or icon
1.3 Display malfunction
1.4 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 ≤ 0.25 mm, no more than three white or black spots present
2.2 Densely spaced: no more than two spots or lines within 3 mm</td><td>2.5</td></tr>
<tr><td rowspan="2">03</td><td rowspan="2">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 QTY</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>3.2 Line type
(as following drawing)


<table>
<tr><th>LENGTH</th><th>WIDTH</th><th>ACCEPTABLE QTY</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>2</td></tr>
<tr><td>L ≤ 2.5</td><td>0.03 < W ≤ 0.05</td><td></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 QTY</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 QTY</td><td>3</td></tr>
</table></td><td>2.5</td></tr>
<tr><td>05</td><td>Scratches</td><td>Follow no. 3 OLED black spots, white spots, contamination</td><td></td></tr>
<tr><td>06</td><td>Chipped glass</td><td>Symbols:
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><th>z: chip thickness</th><th>y: chip width</th><th>x: chip length</th></tr>
<tr><td>z ≤ 1/2 t</td><td>Not over viewing area</td><td>x ≤ 1/8 a</td></tr>
<tr><td>1/2 t < z ≤ 2 t</td><td>Not exceed 1/3 k</td><td>x ≤ 1/8 a</td></tr>
</table>
Note
• If there are 2 or more chips, x is total length of each chip</td><td>2.5</td></tr>
</table>

<table>
<tr><th colspan="4">INSPECTION SPECIFICATION</th></tr>
<tr><th>NO.</th><th>ITEM</th><th>CRITERION</th><th>AQL</th></tr>
<tr><td>06</td><td>Chipped glass</td><td>
6.1.2 Corner crack:



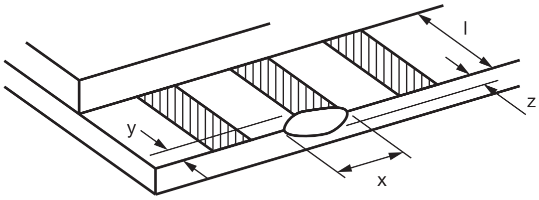
<table>
<tr><td>z: chip thickness</td><td>y: chip width</td><td>x: chip length</td></tr>
<tr><td>z ≤ 1/2 t</td><td>Not over viewing area</td><td>x ≤ 1/8 a</td></tr>
<tr><td>1/2 t < z ≤ 2 t</td><td>Not exceed 1/3 k</td><td>x ≤ 1/8 a</td></tr>
</table>

Note
- If there are 2 or more chips, x is total length of each chip
</td><td>2.5</td></tr>
<tr><td>06</td><td>Glass crack</td><td>
Symbols:

<table>
<tr><td>x: chip length</td><td>y: chip width</td><td>z: chip thickness</td></tr>
<tr><td>k: seal width</td><td>t: glass thickness</td><td>a: OLED side length</td></tr>
<tr><td>l: electrode pad length</td><td></td><td></td></tr>
</table>

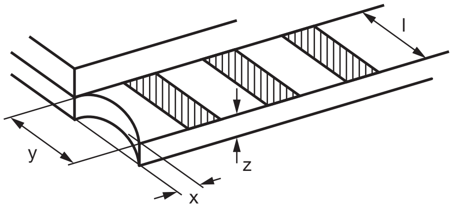
6.2 Protrusion over terminal:

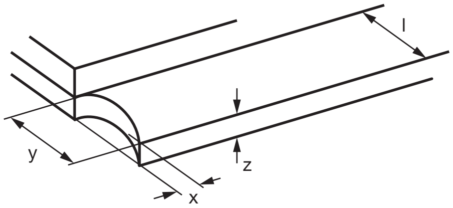
6.2.1 Chip on electrode pad:



<table>
<tr><td>y: chip width</td><td>x: chip length</td><td>z: chip thickness</td></tr>
<tr><td>y ≤ 0.5 mm</td><td>x ≤ 1/8 a</td><td>0 < z ≤ t</td></tr>
</table>

6.2.2 Non-conductive portion:

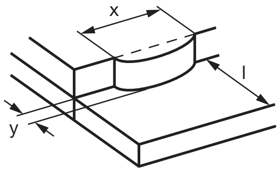




<table>
<tr><td>y: chip width</td><td>x: chip length</td><td>z: chip thickness</td></tr>
<tr><td>y ≤ l</td><td>x ≤ 1/8 a</td><td>0 < z ≤ t</td></tr>
</table>

Notes
- 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

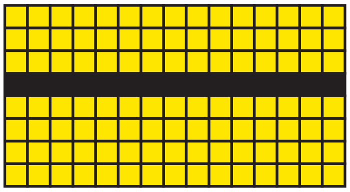
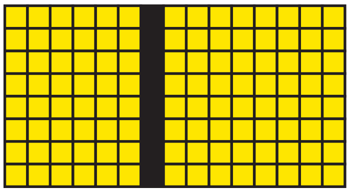
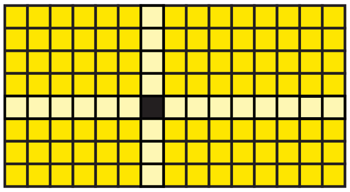
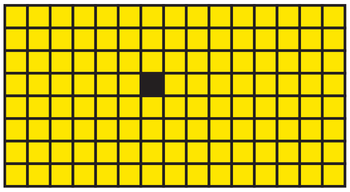
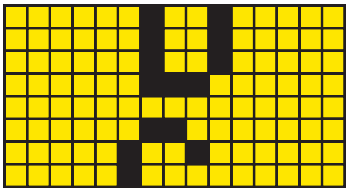
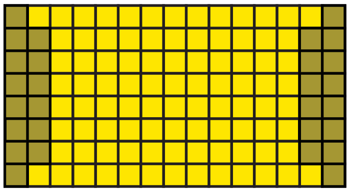
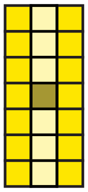
6.2.3 Substrate protuberance and internal crack:



<table>
<tr><td>y: width</td><td>x: length</td></tr>
<tr><td>y ≤ 1/3 l</td><td>x ≤ a</td></tr>
</table>
</td><td>2.5</td></tr>
<tr><td>07</td><td>Cracked glass</td><td>The OLED with extensive crack is not acceptable</td><td>2.5</td></tr>
</table>

INSPECTION SPECIFICATION

NO.	ITEM	CRITERION	AQL
08	Backlight elements	8.1 Illumination source flickers when lit	0.65
		8.2 Spots or scratched that appear when lit must be judged. Using OLED spot, lines and contamination standards	2.5
		8.3 Backlight does not light or color wrong	0.65
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination	2.5
		9.2 Bezel must comply with job specifications	0.65
10	PCB, COB	10.1 COB seal may not have pinholes larger than 0.2 mm 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 2 mm 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

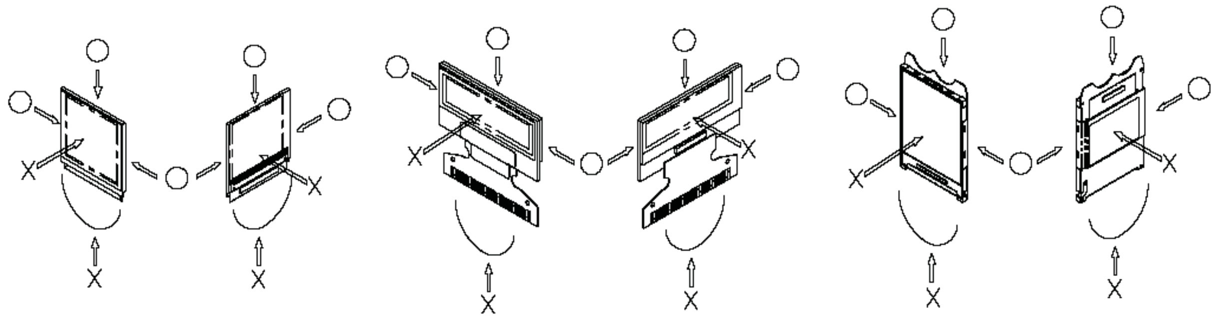
PRECAUTIONS IN USE OF OLED MODULES

MODULES

1. Avoid applying excessive shocks to module or making any alterations or modifications to it
2. Do not make extra holes on the printed circuit board, modify its shape or change the components of OLED display module
3. Do not disassemble the OLED display module
4. Do not operate it above the absolute maximum rating
5. Do not 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 is pretty common to use “screen saver” to extend the lifetime and do not use fix information for long time in real application
9. Do not 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)

HANDLING PRECAUTIONS

1. Since the display panel is being 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 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 equivalent
     Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy. Also, pay attention that the following liquid and solvent may spoil the polarizer:
     - Water
     - Ketone
     - Aromatic solvents
6. 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 no. 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

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

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 V_{IL} and V_{IH} 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 (V_{DD}) (recommend value: 0.5 A)
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

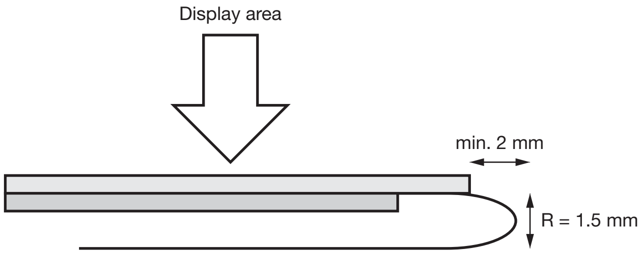
PRECAUTIONS WHEN DISPOSING OF THE OLED DISPLAY MODULES

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

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 and 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
8. The limitation of FPC bending



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