SPECIFICATIONS FOR OLED MODULE

MODEL NO.
BL12864PWRNU$
VER.01

RoHS COMPLIANT

FOR MESSRS:

_____

ON DATE OF:

_____

APPROVED BY:

_____

BOLYMIN, INC.
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History of Version

Version	Contents	Date	Note
01	NEW VERSION	2017/04/07	SPEC.

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BOLYMIN

1. Numbering System

B	L	12864	P	W	R	N	-	U	$
0	1	2	3	4	5	6	7	8	9

0	Brand	Bolymin	
1	Module Type	C= character type G= graphic type P= TAB/TCP type R=color STN	O= COG type F= COF type L=PLED/OLED
2	Format	2002=20 characters, 2 lines 12232= 122 x 32 dots	
3	Version No.	M1 type	
4	LCD Color	W=OLED/White G=STN/gray Y=STN/yellow-green C=color STN	K= OLED/Blue F=FSTN T=TN E=OLED/Yellow
5	LCD Type	R=positive/reflective P=positive/transflective	M=positive/transmissive N=negative/transmissive
6	Backlight type/color	L=LED array/ yellow-green H=LED edge/white R=LED array/red G=LED edge/yellow-green F=RGB Q=LED edge/red A=LED edge/amber N=No backlight	D=LED edge/blue E=EL/white B=EL/blue C=CCFL/white Y=LED Bottom/yellow O=LED array/orange K=LED edge/green A=LED edge/amber
7	CGRAM Font (applied only on character type)	J=English/Japanese Font E=English/European Font G=Chinese(simple) F=Chinese(traditional)	C=English/Cyrillic Font H=English/Hebrew Font A=English/Arabic Font
8	View Angle/ Operating Temperature	B=Bottom/Normal Temperature H=Bottom/Wide Temperature U=Bottom/Ultra wide Temperature	T=Top/Normal Temperature W=Top/Wide Temperature C=9H/Normal Temperature E=Top/ultra wide temperature
9	Special Code	n=positive voltage for LCD $:RoHS	

2. General Specification

(1) Mechanical Dimension

Item	Standard Value	Unit
Number of dots	128×64	dots
Module dimension (L*W*H)	34.5*35.0*1.427	mm
View area	31.42*16.7	mm
Active area	29.42*14.7	mm
Dot size	0.21(W)×0.21(H)	mm
Dot pitch	0.23(W)×0.23 (H)	mm
Color	White	

(2) Controller IC: SH1106G Controller

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3. Absolute Maximum Ratings

Item	Condition	Min	Max	Unit	Remark
Operating Temperature		-40	+70	℃	
Storage Temperature		-40	+85	℃	
Supply Voltage (V_{DD})	Ta = 25°C	-0.3	3.6	V	IC maximum rating
Supply Voltage (V_{BAT})	Ta = 25°C	-0.3	4.8	V	IC maximum rating
Supply Voltage (Vcc)	Ta = 25°C	8	14.5	V	IC maximum rating
Operating lifetime	60cd/m², 50% checkerboard	32000(1)		Hrs	(Charge pump) Note(1)
Operating lifetime	80cd/m², 50% checkerboard	24000(2)		Hrs	(Charge pump) Note(2)

Note:

(A) Under V_{BAT} = 3.6V (Charge Pump), Ta = 25°C, 50% RH.

(B) Life time is defined the amount of time when the luminance has decayed to less than 50% of the initial measured luminance.

(1) Setting of 60 cd/m: (Charge Pump)

- Contrast setting : 0x42
- Frame rate : 105Hz
- Duty setting : 1/64

(2) Setting of 80 cd/m: (Charge Pump)

- Contrast setting : 0x66
- Frame rate : 105Hz
- Duty setting : 1/64

(C) Lifetime should be counted once shipping out from our warehouse . But the exact lifetime must depend on customer's operation enviornment and application.

4. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage (V_{DD})	V_{DD}-V_{SS}	Ta = 25°C	1.65	-	3.5	V
Charge Pump Regulator Supply Voltage(V_{BAT})	V_{BAT}-V_{SS}	Ta = 25°C	3.5	-	4.7	V
Operating Voltage (V_{cc}) (Charge Pump)	V_{cc}-V_{SS}	Ta = 25°C	6.4	-	9	V
Input High Vol	V_{IH}	—	0.8V_{DD}	—	—	V
Input Low Vol	V_{IL}	—	0	—	0.2V_{DD}	V
Output High Vol	V_{OH}	—	0.8V_{DD}	—	—	V
Output Low Vol.	V_{OL}	—	—	—	0.2V_{DD}	V
Supply Current (Charge Pump)	I_{DD}	(All pixels on)Note(1)	—	35	37	mA

(1) Normal mode condition : (Charge Pump) V_{BAT} = 3.6V

- Contrast setting : 0X80 - Frame rate : 105Hz - Duty setting : 1/64

(2) Standby mode condition : : (Charge Pump) V_{BAT} = 3.6V

- Contrast setting : 0x00 - Frame rate : 105Hz - Duty setting : 1/64

(3) Sleep mode condition :

When send 0xae command OLED display off and memory data will be maintained.

(4) Wake up condition :

When send 0xaf command OLED will be turned on.

5. Optical Characteristics

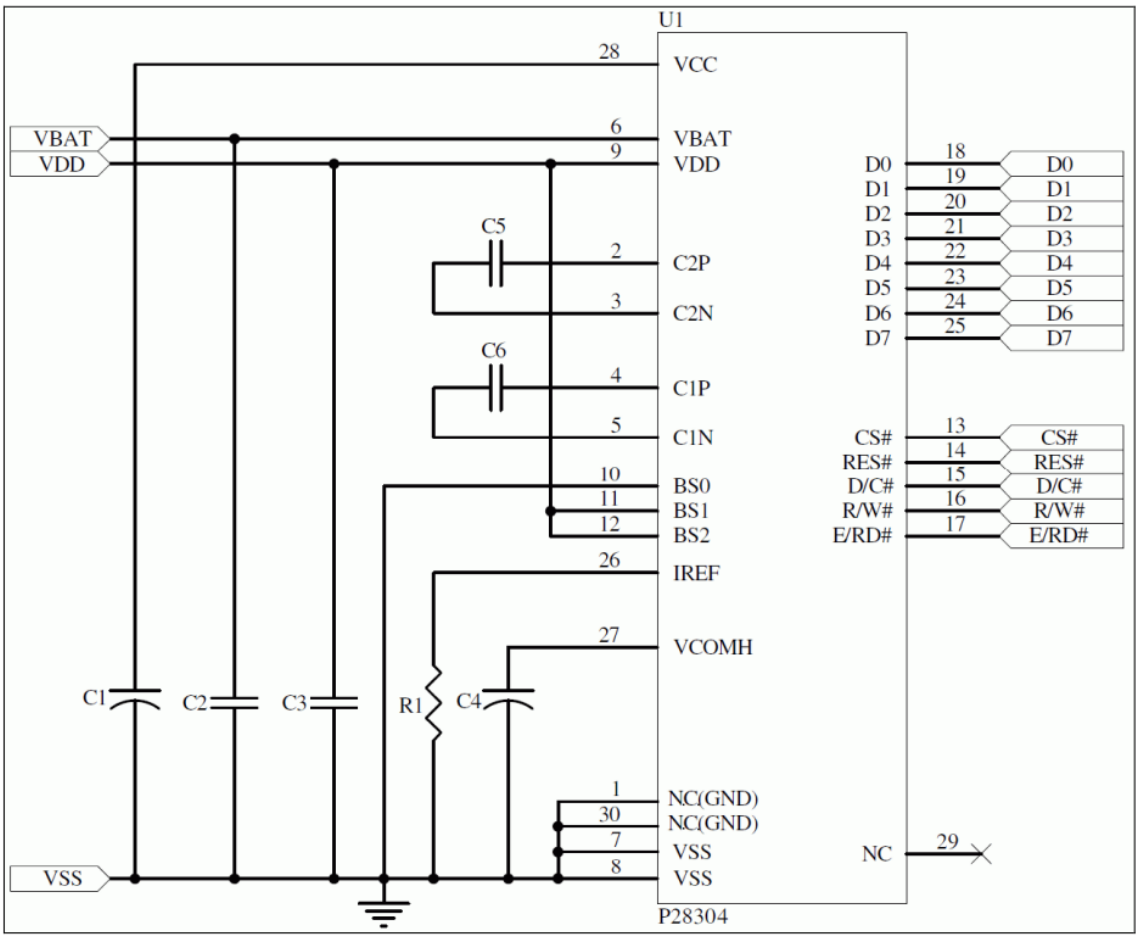
Item	Min.	Typ.	Max.	Unit
View Angle	160	—	—	deg
Dark Room contrast	2000:1	—	—	—
Response Time	—	10	—	us
CIE x (White)	0.25	0.29	0.33	
CIE y (White)	0.27	0.31	0.35	
Normal Luminance	60	80		cd/m2

6. Interface Pin Function

Pin No.	Symbol	Description
1	NC(GND)	Reserved pin. It should be connected to VSS.
2	C2P	C2P/C2N –Pin for charge pump capacitor; Connect to each other with a capacitor.
3	C2N	
4	C1P	C1P/C1N – Pin for charge pump capacitor; Connect to each other with a capacitor.
5	C1N	
6	VBAT	Power supply for charge pump regulator circuit.
7	VSS	Ground pin.
8	VSS	Ground pin.
9	VDD	Power supply pin for core logic operation.
10	BS0	MCU bus interface selection pins.
11	BS1	
12	BS2	
13	CS#	This pin is the chip select input connecting to the MCU.
14	RES#	This pin is reset signal input.
15	D/C#	This pin is Data/Command control pin connecting to the MCU.
16	R/W#	This pin is read / write control input pin connecting to the MCU interface. 8080: data write enable pin; 6800:Read/Write select pin. When serial or I2C interface is selected, this pin must be connected to VSS.
17	E/RD#	8080: data read enable pin; 6800:Read/Write enable pin. When serial or I2C interface is selected, this pin must be connected to VSS.
18	D0	This is an 8-bit bi-directional data bus that connects to an 8-bit standard MPU data bus. When the serial interface is selected, then D0 serves as the serial clock input pad (SCL) and D1 serves as the serial data input pad (SI). At this time, D2 to D7 are set to high impedance. When the I2C interface is selected, then D0 serves as the serial clock input pad (SCL) and D1 serves as the serial data input pad (SDAI). At this time, D2 to D7 are set to high impedance.
19	D1	
20	D2	
21	D3	
22	D4	
23	D5	
24	D6	
25	D7	
26	IREF	This pin is the segment output current reference pin.
27	VCOMH	COM signal deselected voltage level.
28	VCC	Power supply for panel driving voltage.
29	NC	No connection.
30	NC(GND)	Reserved pin. It should be connected to VSS.

7. APPLICATION CIRCUIT

(Charge Pump)



Recommend components:

C1：2.2uF/25V(0805)

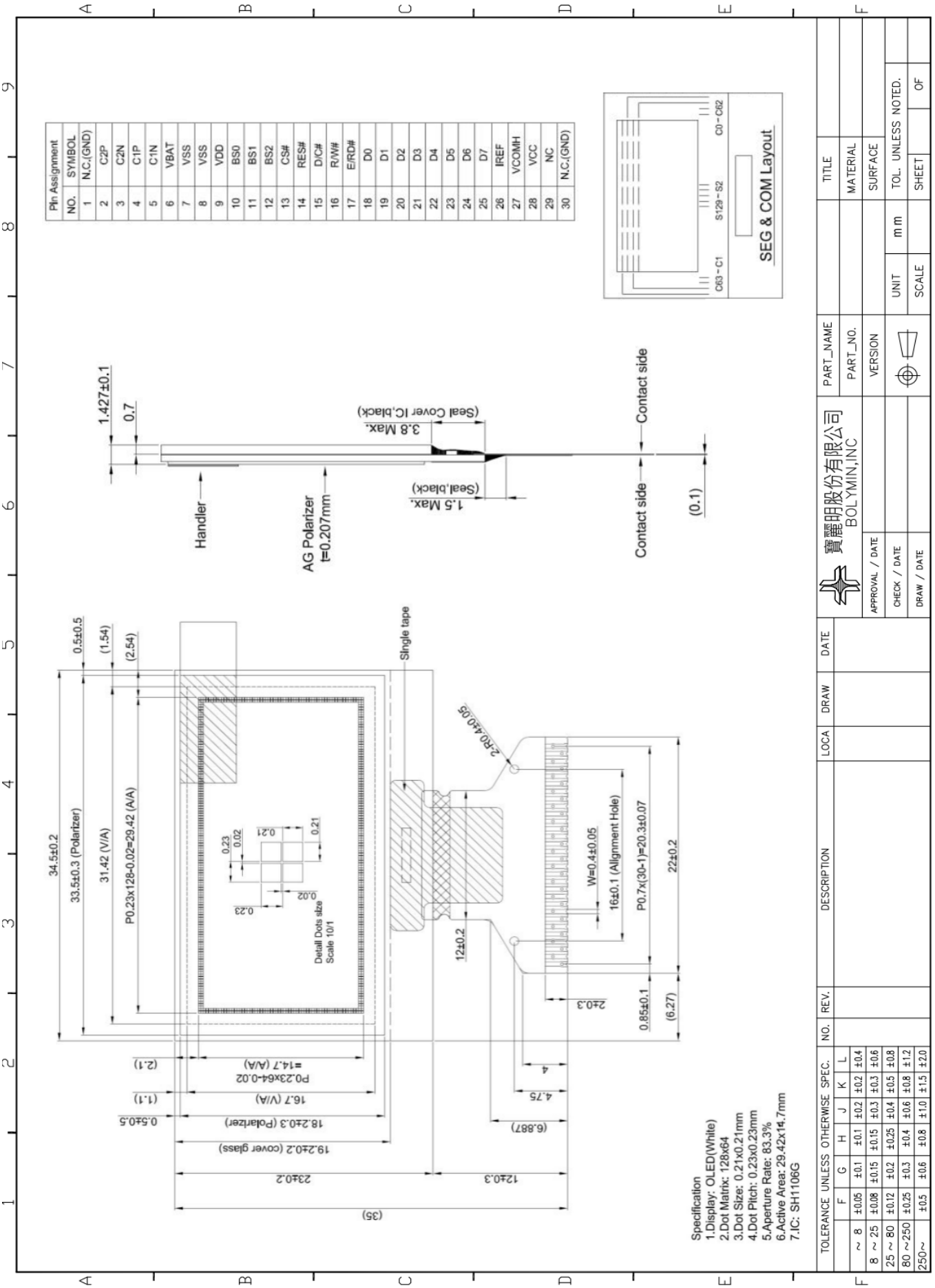
C2,C3,C5,C6：1uF/16V (0603)

C4：4.7uF/25V (Tantalum type) or VISHAY (572D475X0025A2T)

R1：620K ohm (0603) 1%

This circuit is for 8080 8bits interface.

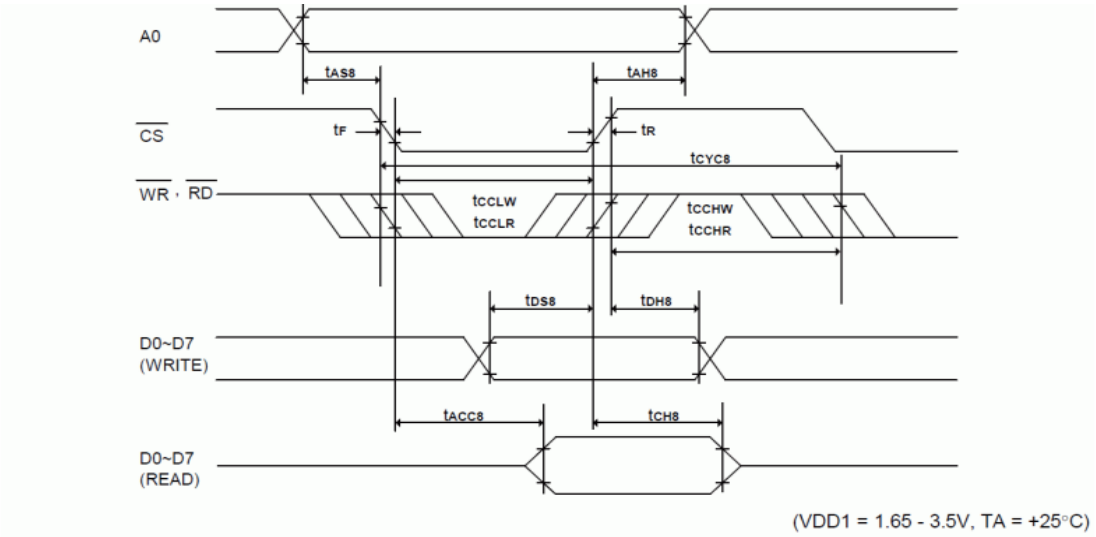
8. Drawing


Pin Assignment
NO. SYMBOL
1 N.C.(GND)
2 C2P
3 C2N
4 C1P
5 C1N
6 VBAT
7 VSS
8 VSS
9 VDD
10 BS0
11 BS1
12 BS2
13 CS#
14 RES#
15 D/C#
16 R/W#
17 E/RD#
18 D0
19 D1
20 D2
21 D3
22 D4
23 D5
24 D6
25 D7
26 IREF
27 VCOMH
28 VCC
29 NC
30 N.C.(GND)
SEG & COM Layout
C63~C1
S129~S2
C0~C62
1.427±0.1
0.7
3.8 Max.
(Seal Cover IC,black)
1.5 Max.
(Seal,black)
Handler
AG Polarizer
t=0.207mm
Contact side
Contact side
(0.1)
Single tape
34.5±0.2
33.5±0.3 (Polarizer)
31.42 (V/A)
P0.23x128-0.02=29.42 (A/A)
0.5±0.5
(1.54)
(2.54)
Detail Dots size
Scale 10/1
0.23
0.02
0.21
2.R0.4±0.05
W=0.4±0.05
16±0.1 (Allgnment Hole)
P0.7x(30-1)=20.3±0.07
22±0.2
12±0.2
2±0.3
0.85±0.1
(6.27)
4
4.75
(6.887)
12±0.3
23±0.2
(35)
19.2±0.2 (cover glass)
18.2±0.3 (Polarizer)
16.7 (V/A)
P0.23x64-0.02
=14.7 (A/A)
(2.1)
(1.1)
0.5±0.5
Specification
1.Display: OLED(White)
2.Dot Matrix: 128x64
3.Dot Size: 0.21x0.21mm
4.Dot Pitch: 0.23x0.23mm
5.Aperture Rate: 83.3%
6.Active Area: 29.42x14.7mm
7.IC: SH1106G
寶麗明股份有限公司
BOLYMIN,INC
PART_NAME
PART_NO.
VERSION
APPROVAL / DATE
CHECK / DATE
DRAW / DATE
UNIT
m m
SCALE
TITLE
MATERIAL
SURFACE
TOL. UNLESS NOTED.
SHEET
OF
TOLERANCE UNLESS OTHERWISE SPEC.
NO. REV. DESCRIPTION LOCA DRAW DATE
F G H J K L
~ 8 ±0.05 ±0.1 ±0.1 ±0.2 ±0.2 ±0.4
8 ~ 25 ±0.08 ±0.15 ±0.15 ±0.3 ±0.3 ±0.6
25 ~ 80 ±0.12 ±0.2 ±0.25 ±0.4 ±0.5 ±0.8
80 ~250 ±0.25 ±0.3 ±0.4 ±0.6 ±0.8 ±1.2
250~ ±0.5 ±0.6 ±0.8 ±1.0 ±1.5 ±2.0

9. SH1106 controller data

9.1 Timing Characteristics

8080 Interface



(VDD1 = 1.65 - 3.5V, TA = +25°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tCYC8	System cycle time	600	-	-	ns	
tAS8	Address setup time	0	-	-	ns	
tAH8	Address hold time	0	-	-	ns	
tDS8	Data setup time	80	-	-	ns	
tDH8	Data hold time	30	-	-	ns	
tCH8	Output disable time	20	-	140	ns	CL = 100pF
tACC8	$\overline{RD}$ access time	-	-	280	ns	CL = 100pF
tCCLW	Control L pulse width (WR)	200	-	-	ns	
tCCLR	Control L pulse width (RD)	240	-	-	ns	
tCCHW	Control H pulse width (WR)	200	-	-	ns	
tCCHR	Control H pulse width (RD)	200	-	-	ns	
tR	Rise time	-	-	30	ns	
tF	Fall time	-	-	30	ns	

(VDD1 = 2.4 - 3.5V, TA = +25°C)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
tCYC8	System cycle time	300	-	-	ns	
tAS8	Address setup time	0	-	-	ns	
tAH8	Address hold time	0	-	-	ns	
tDS8	Data setup time	40	-	-	ns	
tDH8	Data hold time	15	-	-	ns	
tCH8	Output disable time	10	-	70	ns	CL = 100pF
tACC8	$\overline{RD}$ access time	-	-	140	ns	CL = 100pF
tCCLW	Control L pulse width (WR)	100	-	-	ns	
tCCLR	Control L pulse width (RD)	120	-	-	ns	
tCCHW	Control H pulse width (WR)	100	-	-	ns	
tCCHR	Control H pulse width (RD)	100	-	-	ns	
tR	Rise time	-	-	15	ns	
tF	Fall time	-	-	15	ns	

9.2 Display Control Instruction

Refer to SH1106 IC Spec.

10. Quality Assurance

10.1 Inspection conditions

1. The inspection and meaurement are performed under the following conditions, unless otherwise specified.
2. Temperature: 25±5°C
3. Humidity: 50±10%R.H.
4. Distance between the panel and eyes of the inspector≧30cm
5. MIL-STD-105E/inspection level II/normal inspection/single sample inspection

10.2 Inspection Parameters

Severity	Inspection Item	Defect	Remark
Major Defect	1. Panel	(1) Non-displaying	
		(2) Line defects	
		(3) Malfunction	
		(4) Glass cracked	
	2. Film	(1) Film dimension out of specification	Can not be assembled
	3. Dimension	(1) Outline dimension out of specification	
Minor Defect	1. Panel	(1) Glass scratch	Appearance defect
		(2) Glass cutting NG	
		(3) Glass chip	
	2. Polarizer	(1) Polarizer scratch	
		(2) Stains on surface	
		(3) Polarizer bubbles	
	3. Displaying	(1) Dim spot、Bright spot、dust	
	4. Film	(1) Damage (2) Foreign material	

<table>
<tr><th>Description</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>1. Glass scratch</td><td>
<table>
<tr><th>Width (mm)
W</th><th>Length (mm)
L</th><th>number of pieces permitted</th></tr>
<tr><td>W≦0.03</td><td>Ignore</td><td>Ignore</td></tr>
<tr><td>0.03＜ W≦0.05</td><td>L≦3</td><td>3</td></tr>
<tr><td>0.05＜ W</td><td>------</td><td>None</td></tr>
<tr><td>beyond A.A.</td><td>------</td><td>Ignore</td></tr>
</table>
</td><td>2.5</td></tr>
<tr><td>2. Polarizer bubble</td><td>
<table>
<tr><th>Size</th><th>number of pieces permitted</th></tr>
<tr><td>Φ ≦0.2</td><td>Ignore</td></tr>
<tr><td>0.2＜Φ ≦0.5</td><td>2</td></tr>
<tr><td>0.5＜Φ</td><td>0</td></tr>
<tr><td>beyond A.A.</td><td>Ignore</td></tr>
</table>
</td><td>2.5</td></tr>
<tr><td>3. Dimming spot、
Lighting spot、
Dust</td><td>
<table>
<tr><th>average</th><th>number of</th></tr>
<tr><td>D ≦0.1</td><td>Ignore</td></tr>
<tr><td>0.1＜ D ≦0.15</td><td>2</td></tr>
<tr><td>0.15＜ D ≦0.2</td><td>1</td></tr>
<tr><td>0.2 ＜ D</td><td>0</td></tr>
<tr><td>beyond A.A.</td><td>Ignore</td></tr>
</table>
D=(long diameter + short diameter)/2.
Pixel off is not allowed.
</td><td>2.5</td></tr>
</table>

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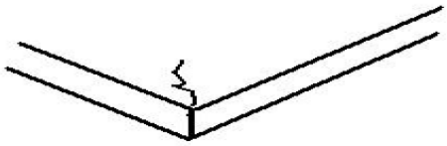
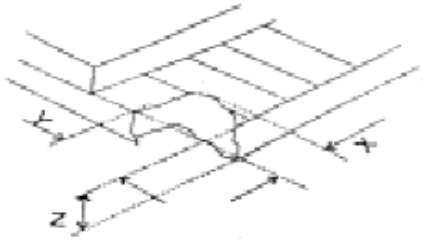
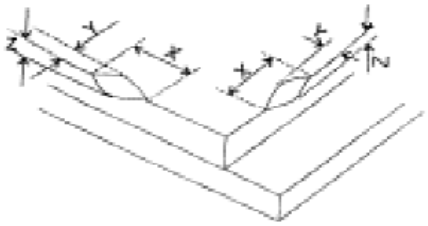
<table>
<tr>
<td>4. Damage</td>
<td>1. Glass crack：Propagation crack is not acceptable.
 
2. Chip on corner
 
(mm)
X ≦1.5
Y ≦2.0
Z ≦t
3. Chip on edge
 
(mm)
X ≦3.0
Y ≦2.0
Z ≦t
Note：t= Glass Thickness
4. Chip on the corner extending into the ITO contact is not acceptable.</td>
<td>2.5</td>
</tr>
</table>

10.3 WARRANTY POLICY

Bolymin . Will provide one-year warranty for the products only if under specification operating conditions.
If there are functional defects found during the period of warranty, the defective products would be replaced on a one-to-one basis.
Bolymin would not be responsible for any direct/indirect liabilities consequential to any parties.

10.4 MTBF

10.4.1 .MTBF based on specific test condition is 24K hours.

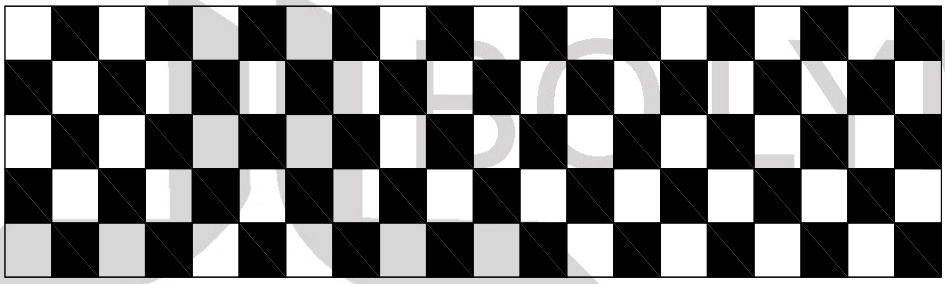
10.4.2 Test Condition:

10.4.2.1 Supply Voltage: V_{BAT} = 3.6V

10.4.2.2 Luminance: 80 cd/m2

10.4.2.3 Operation temperature and humidity: 25 ℃ and 50%RH

10.4.2.4 Run-Patterns:



10.4.3 Test Criteria:

Luminace has decayed to less than 50% of the initial measured luminance.

11.Reliability

■**Content of Reliability Test**

NO.	Items.	Specification	Applicable Standard
1	High temp. (Non-operation)	85°C, 240hrs	——
2	High temp. (Operation)	70°C, 120hrs	——
3	Low temp. (Operation)	-40°C, 120hrs	——
4	High temp. / High. humidity (Operation)	65°C, 90%RH, 120hrs	——
5	Thermal shock(Non-operation)	-40°C ~85°C (-40°C /30min; transit /3min; 85°C /30min; transit /3min) 1cycle: 66min, 100 cycles.	——
6	Vibration	Frequency : 5~50HZ, 0.5G Scan rate : 1 oct/min Time : 2 hrs/axis Test axis : X, Y, Z	——

Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability.
2. All-pixels-on is used as operation test pattern.
3. The degradation of Polarizer are ignored for item 1 & 4 & 5.

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.

Reliability Test

Bolymin only guarantees the reliability of the panel under the test conditions and durations listed in the specification, and is not responsible for any test results that are conducted using more stringent conditions and/or with lengthened durations. Also, when the testing the panel in a chamber or oven, make sure they won't produce any condensation on the panel, especially on the electrical leads, before lighting on the panel to see if it passes the test. Also the panel should rest for about an hour at room temperature and pressure before the measurement, as indicated in the specification. Be aware that one should use fresh panel for each of the reliability test items listed in the specification, in other words, don't use the panels that were tested for subsequent tests.

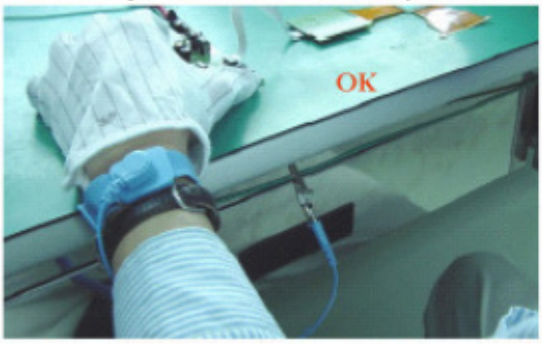
12.Precautions for Handling

12.1 When handling the module, wear powder-free antistatic rubber finger cots, and be careful not to bend and twist it.

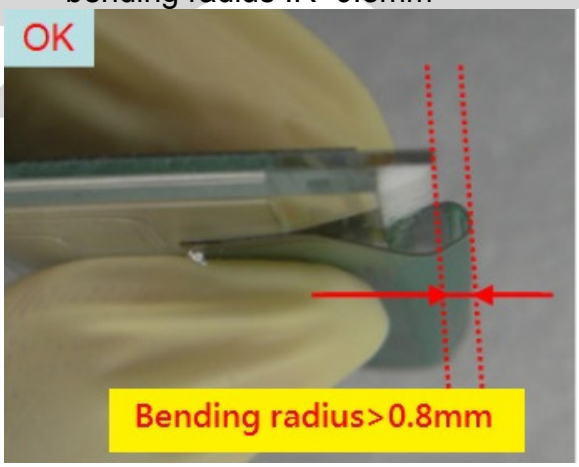
12.2 The OLED module is consisted of glass and film, and it should avoid pressure, strong impact, or being dropped from a height.

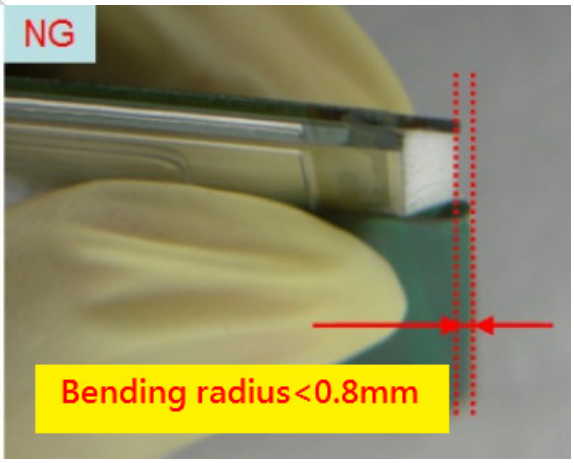
12.3 The OLED module is an electronic component and is subject to damage caused by Electro Static

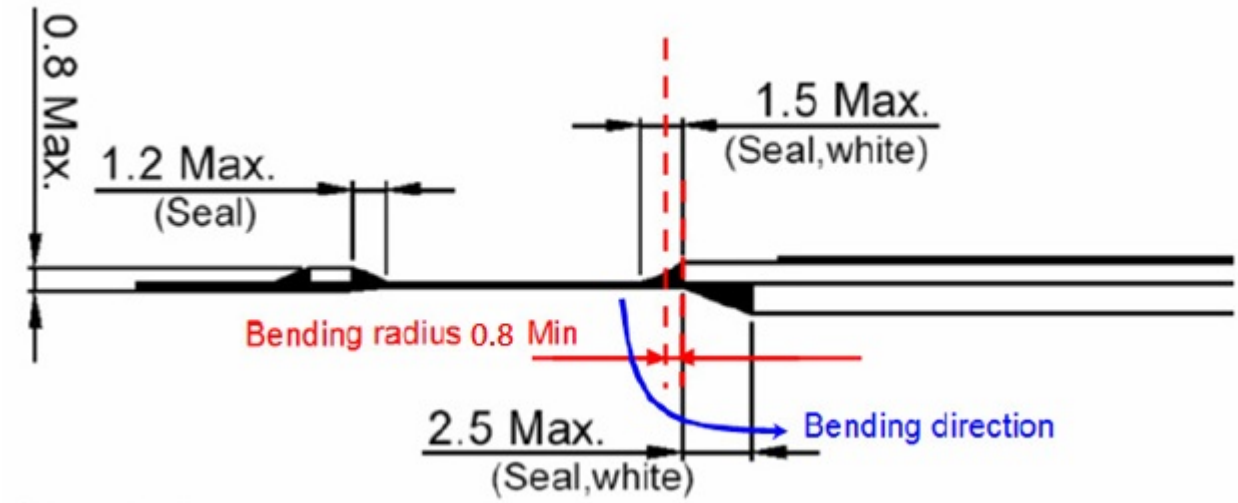
Discharge (ESD) and hence normal ESD precautions must be taken when handling it. Also, appropriate ESD protective environment must be administered and maintained in the production line. When handling and assembling the panel, wear an antistatic wrist strap with the alligator clip attached to the ground to prevent ESD damage on the panel. Also, ground the tools being used for panel assembly and make sure the working environment is not too dry to cause ESD problems. (See the photos below).



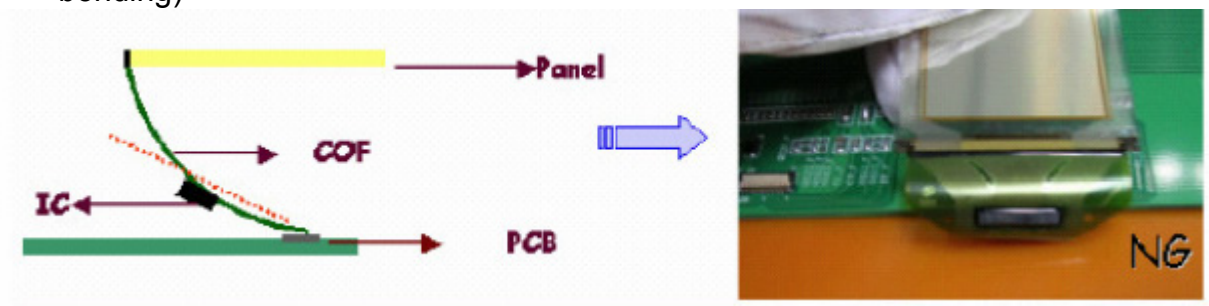
12.4 Please do not bend the film near the substrate glass.(this could cause film peeling and COF damage) and the peeling strength about 600g/cm, the bending <20times and the bending radius :R>0.8mm



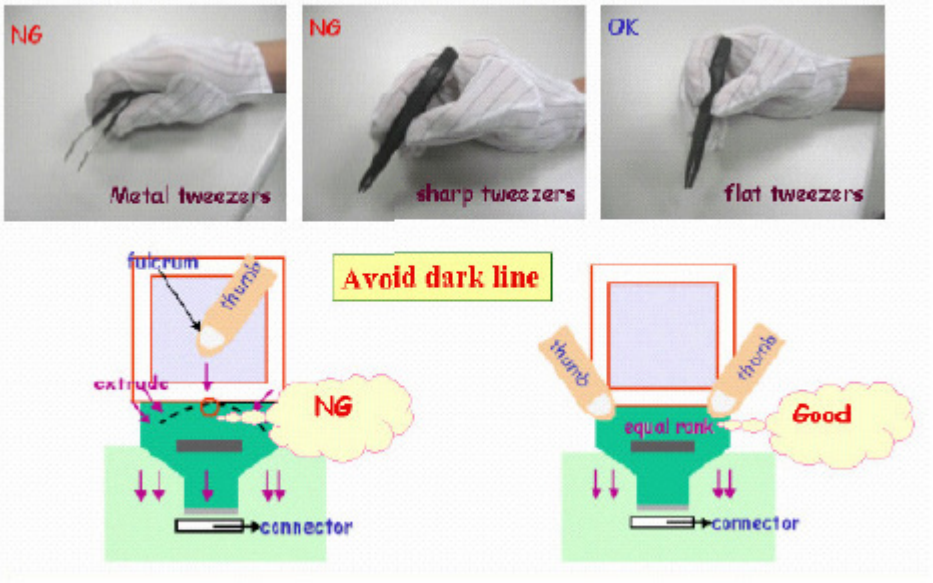




12.5 Avoid bending the film at IC bonding area.(>1.5mm)(this could damage the ILB bonding)



12.6 Use both thumbs to insert COF into the connector when assembling the panel. See the photo on the far right below for correct insertion of the film into the connector (one-handed insertion exerts uneven force on the film and could cause its breakage, photo on the left)



12.7 Do not wipe the pin of film with the dry or hard materials that will damage the surface. When cleaning the display surface, use soft cloth solvent and wipe gently (Recommend solvent: IPA, alcohol), and do not wipe the display with dry or hard materials that will damage the polarizer surface and do not use the solvent like: Water, Acetone, Aromatic

13. Precautions for Electrical

13.1. Design using the settings in the specification

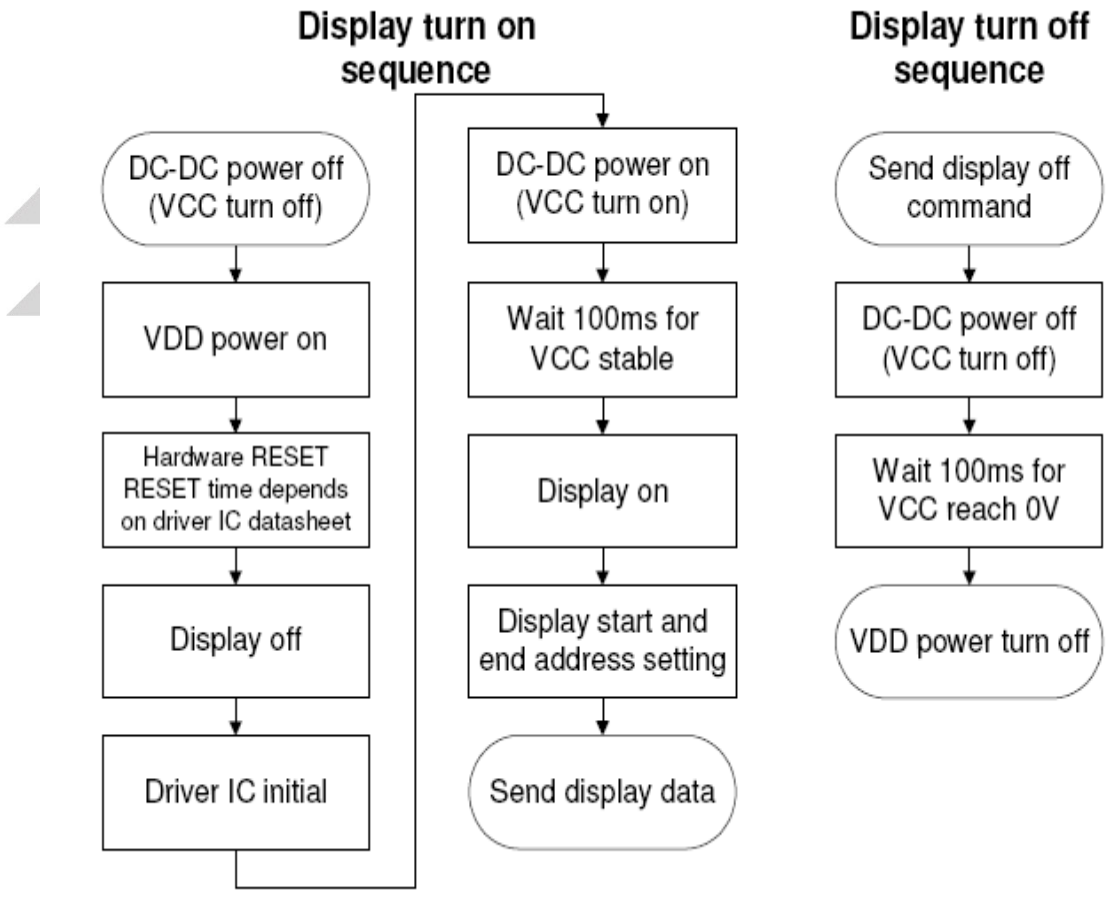
It is extremely important to design and operate the panel using the settings listed in the specification. This includes voltage, current, frame rate, duty cycle... etc. Operation of the OLED outside the specified range in the specification should be entirely avoided to ensure proper operation of the OLED.

13.2. Maximum Ratings

To ensure proper operation of the panel, never design the panel with parameters running over the maximum ratings listed in the specification. Also the logic voltages such as VIL and VIH have to be within the specified range in the specification to prevent any improper operation of the panel.

13.3 Power on/off procedure

Any operation that does not comply with the procedure could cause permanent damage of the IC and should be avoided. When the logic power is not on, do not activate any input signal. Abrupt shutdown of power to the module, while the OLED panel is on, could cause OLED panel malfunctioning.



13.4 Power savings

To save power consumption of the OLED, one can use partial display or sleep mode when the panel is not fully activated. Also, if possible, make maximum use of black background to save power. The OLED is a self-luminous device, and a particular pixel cluster or image can be lit on via software control, so power savings can be achieved by partial display or dimming down the luminance. Depending on the application, the user can choose among Ultra Bright Mode, Normal Operation Mode, and Sleeping Mode.

The power consumption is almost in direct proportion to the brightness of the panel, and also in direct proportion to the number of pixels lit on the panel, so the customer can save the power by the use of black background and Sleeping Mode. One benefit from using these design schemes is the extension of the OLED lifetime.

13.5 Residual Image (Image Sticking)

The OLED is a self-emissive device. As with other self-emissive device or displays consisting of self-emissive pixels, when a static image frozen for a long period of time is changed to another one with all-pixels-on background, residual image or image sticking is noticed by the human eye. Image sticking is due to the luminance difference or contrast between the pixels that were previously turned on and the pixels that are newly turned on. The time when image sticking happens depends on the luminance decay curve of the display. The slower the decay, the less prominent the image sticking is. It is strongly recommended that the user employ the following three strategies to minimize image sticking

13.5.1 Employ image scrolling or animation to even out the lit-on time of each and every pixel on the display, also could use sleeping mode for reduced the residual image and extend the power capacity.

13.5.2 Minimize the use of all-pixels-on or full white background in their application because when the panel is turned on full white, the image sticking from previously shown patterns is the most revealing. Black background is the best for power savings, greatest visibility, eye appealing, and dazzling displays

13.5.3 If in the reliability test when a static logo is used, change the pattern into its inverse (i.e., turn off the while pixels and turn on the previously unlit pixels) and freeze the inverse pattern as long as the original logo is used, so every pixel on the panel can be lit on for about the same time to minimize image sticking, caused by the differential turn-on time between the original and its reverse patterns

14. Precautions for Storage

Although the storage conditions and guarantee period are indicated in the specification, it is advisable to store the packed cartons or packages at 23℃±5℃,55%±10%RH(Note A), Do not store the OLED module under direct sunlight or UV light and for best panel performance. The constant working OLED display module decays slower than the module that is not working. And it's better to use the module on the field within one month after unpacking the package.

Note (A):

Vacuum Packaging

Desiccant x 2

Humidity indicator card

Humidity indicator card

As the humidity increases, the chemically impregnated spots change from a brown color (DRY) to a blue color (HUMID).