

MODEL NO. <u>BL25664D-LRNNH\$</u> <u>VER.01</u>



FOR MESSRS:

ON DATE OF:

APPROVED BY:

BOLYMIN, INC.

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History of Version

Version	Contents	Date	Note
01	NEW VERSION	2019/10/30	SPEC.
		ЛТ	

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1. Numbering System

В	L	25664	D	-	L	R	Ν	Ν	Н		\$	
0	1	2	3		4	5	6	7	8	9	10	11

0	Bolymin	В							
		С	Character	type	Р	TAB /TCP type			
		F	COF type		R	Color STN			
1	Module Type	G	Graphic typ	De	L	OLED			
		0	COG type		Z	Customize			
			2004	20 character type,4	lines				
2	Format	-	12232	122 × 32 dots					
3	Version No.	D			_				
		В	STN / Blue	, OLED/Blue	н	HTN			
		С	Color		Т	TN			
		F	FSTN		Y	STN/Yellow-green			
		G	STN/Grey		D	OLED/Blue+Yellow			
4	LCD Color	А	OLED/Blue	+Yellow+Green	Е	OLED/Yellow			
		T	OLED/Gree	en	R	OLED/RED			
		W	OLED/Whi	te	J	ASTN			
		К	DFSTN		V	VALCD			
		R	Positive/ref	flective	М	Positive/ transmissive			
5	LCD Type	Р	Positive/tra	insflective	Ν	Negative/ transmissive			
		Т	Negative/ t	ransflective					
		L	(LED)Array/ye	ellow-green	G	(LED)Edge/yellow-green			
		М	(LED)Array/a		Н	(LED)Edge/white			
		R	(LED)Array/re		D	(LED)Edge/blue			
	Backlight	U	(LED)Array/b		E	(EL)white			
6	type/color	W	(LED)Array/w		B				
	-71	С	(CCFL) white		F	(LED)Array/RGB			
		Y	(LED)Array/y		N	No backlight			
		0	(LED)Array/o	-	K	(LED)Edge/green			
		Α	(LED)Edge/a		Q	(LED) Edge/red			
		J	(LED)Array/g	reen		(LED)Edge/RGB			

					BOLYMIN
		Z	(LED) arrayred/green	Р	(LED)Edge/orange
		S	(LED)edge/RGW	Т	(LED)edge red/green
		V	EL blue/green [、]	х	(LED) Edgewhite /red
	CGRAM Font	J	English/Japanese Font	С	English/Cyrillic Font
		G	Chinese(simple)	н	English/Hebrew Font
		Е	English/European Font (ST7066U0B-BB)	S	English/European Font (ST7066U-0E-BB)
7		F	Chinese(traditional)	М	Japanese-Kanji
		Z	Z=Chinese(simple)+Chinese (traditional)+Japanese+Korean	к	Korean (only for BG16032A BG24064C)
		А	English/Arabic Font	D	Chinese (simple/traditional) English/Japanese
		в	English/Japanese/European		None
		В	Bottom/Normal Temperature06:00	W	Top/Wide Temperature 12:00
		Н	Bottom/Wide Temperature 06:00	Е	Top/Ultra Temperature 12:00
8	View Angle /Operation	С	9H/Normal Temperature 09:00	U	Bottom/Ultra wide Temperature 06:00
0	Temperature	т	Top/Normal Temperature 12:00	F	9H/Ultra wide Temperature 09:00
		G	3H/Wide Temperature 3:00	D	9H/Wide Temperature 09:00
		I	3H/ Ultra Wide Temperature 3:00		
9	Special Code	N	Positive voltage for LCD	Т	Negative voltage and Temperature compensation for LCD
		Ρ	Touch panel	3/5	3/5 voltage logic power supply
10	RoHS	\$			
11	Customer Code	<u>00</u> 0	$\sim \underline{99} 0 \rightarrow \underline{AA} 0 \sim \underline{ZZ} 0$		



2. General Specification

(1) Mechanical Dimension

Standard Value	
Standard Value	Unit
256×64	dots
146.0 x 65.0 x 2.0	mm
137.65 x 35.89	mm
135.65 x 33.89	mm
0.5 x 0.5	mm
0.53 x 0.53	mm
ntroller	Ν
	256×64 146.0 x 65.0 x 2.0 137.65 x 35.89 135.65 x 33.89 0.5 x 0.5 0.53 x 0.53

- (2) Controller IC: SSD1322 Controller
- (3) Temperature Range

Operating	-40 ~ +70 °C	
Storage	-40 ~ +85 ℃	



3. Absolute Maximum Ratings

Item	Symbol	Condition	Min	Max	Unit
Operating Temperature	Тор		-40	+70	°C
Storage Temperature	Тѕт		-40	+85	°C
Supply Voltage for Operation	V _{CI}		-0.3	4.0	V
Supply Voltage for Logic	Vdd		-0.5	2.75	V
Supply Voltage for I/O Pins	Vddio		-0.5	V _{CI}	V
Supply Voltage for Display	Vcc		-0.5	16.0	V
		80cd/m², 50%	400000		Line
Operating life time		checkerboard	100000		Hrs
		60cd/m², 50%	150000		Lino
Operating life time		checkerboard	150000		Hrs

Note 1: All the above voltages are on the basis of " $V_{SS} = 0V$ ".

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 "Optics & Electrical Characteristics".

If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

- Note 3: The define temperature ranges do not include the polarizer. The maximum withstood temperature of the polarizer should be 80°C.
- Note 4: V_{CC} = 15.0V, T a = 25°C, 50% Checkerboard. Software configuration follows initialization. End of lifetime is specified as 50% of initial brightness reached. The average operating lifetime at room temperature is estimated by the accelerated operation at high temperature conditions.
- Note5: Lifetime should be counted once shipping out from our warehouse . But the exact lifetime must depend on customer's operation environment and application.



4. Electrical Characteristics

Item	Symbol	Condition	Min.	Тур.	Max.	Unit
Supply Voltage for Operation	V _{CI}		2.4	2.8	3.5	
Supply Voltage for Logic	V _{DD}	_	2.4	2.5	2.6	V
Supply Voltage for I/O Pins	Vddio		1.65	1.8	V _{CI}	
Supply Voltage for Display (Supplied Externally)	V _{cc}	Note 6	14.5	15.0	15.5	V
Input High Vol	VIH	—	0.8V _{DD}	_	V _{DD}	V
Input Low Vol	VIL	_	_	_	0.2V _{DD}	V
Operating Current for V _{CC} (V _{CC} Supplied Externally)	I _{CC}	Note 7	_	64	80	m A

Note 6: Brightness (L br) and Supply Voltage for Display (V_{CC}) are subject to the change of the panel characteristics and the customer's request. N

Note 7: VCI = 2.8V, VCC = 15V, 100% Display Area Turn on.

5. Optical Characteristics

Item	Min.	Тур.	Max.	Unit
View Angle	_	Free	_	deg
Dark Room contrast	_	>10000:1	_	_
Pixel Luminance	68	80		cd/m2
CIE x (Green)	0.27	0.31	0.35	
CIE y (Green)	0.58	0.62	0.66	

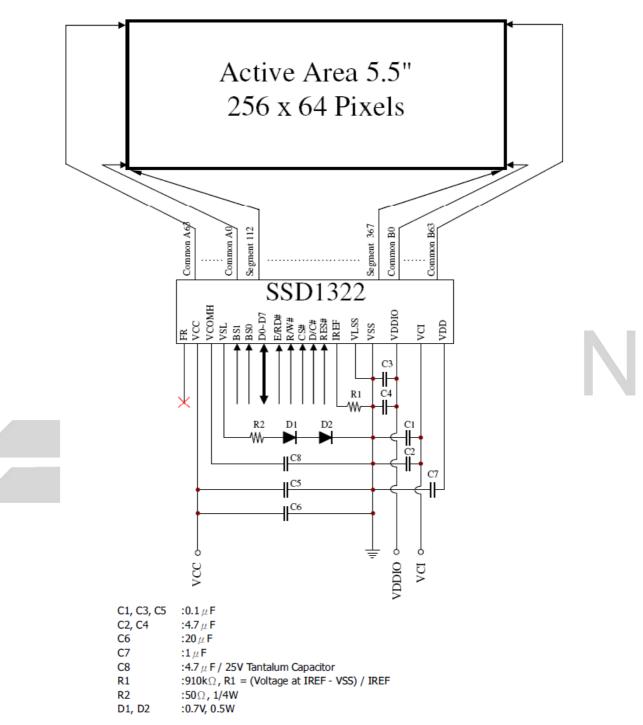
6. Interface Pin Function

Pin Number	Symbol	I/O		Functio	on					
Power Supply	V									
26	VCI	Р	Power Supply for O This is a voltage supply p should be equal to or high	oin. It must be		external source &				
25	VDD	Ρ	Power Supply for Core Logiic Ciircuit This is a voltage supply pin. It can be supplied externally (within the range of 2.4~2.6V) or regulated internally from V_{CI} . A capacitor should be connected between this pin & V_{SS} under all circumstances.							
24	VDDIO	Ρ	Power Supply for I/O Piin This pin is a power supply pin of I/O buffer. It should be connected to VCI or external source. All I/O signal should have VIH reference to VDDIO. When I/O signal pins (BS0~BS1, D0~D7, control signals) pull high, they should be connected to VDDIO.							
2	VSS	Ρ	Ground of Logiic Cii This is a ground pin. It als be connected to external g	o acts as a re	ference for the	e logic pins. It must				
3,29	VCC	Ρ	Power Supply for OEL Panell These are the most positive voltage supply pin of the chip. They must be connected to external source.							
5,28	VLSS	Ρ	Ground of Anallog Ciircuiit These are the analog ground pins. They should be connected to VSS externally.							
Driver										
22	IREF		Current Reference for Briightness Adjjustment This pin is segment current reference pin. A resistor should be connected between this pin and VSS. Set the current at 10µA maximum.							
4	VCOMH	Р	Volltage Output Hiigl This pin is the input pin for A tantalum capacitor shoul	the voltage or	utput high leve	I for COM signals.				
27	VSL	Ρ	Volltage Output Low This is segment voltage re When external VSL is not of When external VSL is us diode to ground.	ference pin. used, this pin s	should be left o	open.				
Testing Pads			1							
21	FR	0	Frame Frequency Tri This pin will send out a s status.Nothing should be individually.	signal that cou	uld be used to					
Interface		n	1							
16 17	BS0 BS1	I	Communiicatiing Pro These pins are MCU interf 3-wire Serial 4-wire Serial 8-bit 68XX Parallel 8-bit 80XX Parallel			following table:				
20	RES#	I	Power Reset for Con This pin is reset signal inp is executed. Keep this pin	ut. When the	pin is low, initia					
19	CS#	I	Chiip Sellect This pin is the chip select i The chip is enabled for MC	nput.						



Din Manuali an	Oursels al	1/0	Function						
Pin Number	Symbol	I/O	Function						
18	D/C#	Ι	Data/Command Controll This pin is Data/Command control pin. When the pin is pulled high, the input at D7~D0 is treated as display data. When the pin is pulled low, the input at D7~D0 will be transferred to the command register. When the pin is pulled high and serial interface mode is selected, the data at SDIN is treated as data. When it is pulled low, the data at SDIN will be transferred to the command register. When 3-wire serial mode is selected, this pin must be connected to VSS. For detail relationship to MCU interface signals, please refer to the Timing Characteristics Diagrams.						
14	E/RD#	I	Read/Wriite Enablle or Read This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled high and the CS# is pulled low. When connecting to an 80XX-microprocessor, this pin receives the Read (RD#) signal. Data read operation is initiated when this pin is pulled low and CS# is pulled low. When serial mode is selected, this pin must be connected to V _{SS} .						
15	R/W#	I	Read/Wriite Sellect or Wriite This pin is MCU interface input. When interfacing to a 68XX-series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Pull this pin to "High" for read mode and pull it to "Low" for write mode. When 80XX interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled low and the CS# is pulled low. When serial mode is selected, this pin must be connected to VSS.						
6~13	D7~D0	1/0	Host Data Input/Output Bus These pins are 8-bit bi-directional data bus to be connected to the microprocessor's data bus. When serial mode is selected, D1 will be the serial data input SDIN and D0 will be the serial clock input SCLK. Unused pins must be connected to VSS except for D2 in serial mode.						
Reserve									
23	N.C.	-	Reserved Piin The N.C. pin between function pins is reserved for compatible and flexible design.						
1,30	N.C. (GND)		Reserved Piin (Supportiing Piin) The supporting pins can reduce the influences from stresses on the function pins. These pins must be connected to external ground as the ESD protection circuit.						

7. Block Diagram



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MCU Interface Selection Pins connected to MCU interface

: Base on BS0 and BS1 connection

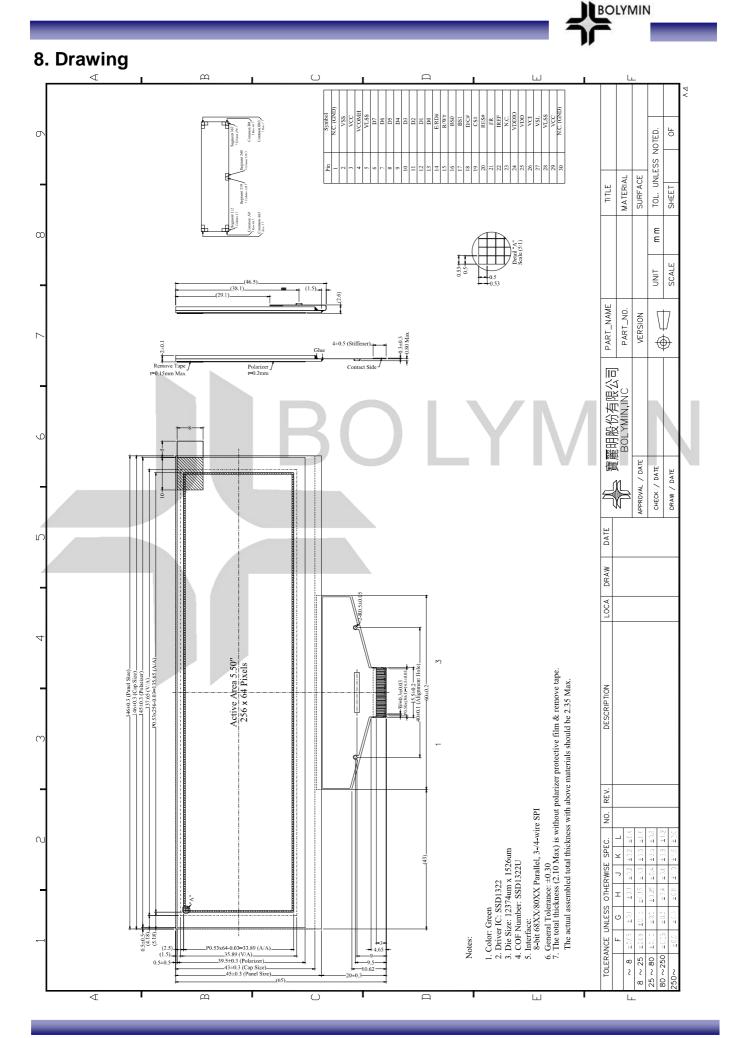
Pins connected to MCU interface : D7~D0, E/RD#, R/W#, D/C#, CS#, and RES#

Showed as below table :

	Showed as below table i															
	BS1	1 BS0	Interface					Data	bus				(Control b	us	
DS	D31		mode	D7	D6	D5	D4	D3	D2	D1	D0	CS#	D/C#	R/W#	E/RD#	RES#
	0	0	4-wire SPI	0	0	0	0	0	NC	SDIN	SCLK	CS#	D/C#	0	0	RES#
	0	1	3-wire SPI	0	0	0	0	0	NC	SDIN	SCLK	CS#	0	0	0	RES#
	1	0	8bit 8080	D7	D6	D5	D4	D3	D2	D1	D0	CS#	D/C#	R/W#	E	RES#
	1	1	8bit 6800	D7	D6	D5	D4	D3	D2	D1	D0	CS#	D/C#	WR#	RD#	RES#

Note :

- a. "0" is connected to VSS.
- b. "1" is connected to VDD.
- c. " NC " is non-connected.



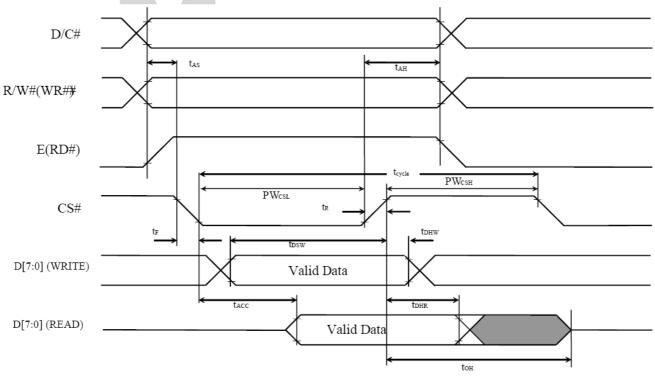


9. SSD1322 controller data

9.1 Timing Characteristics 68XX-Series MPU Parallel Interface Timing Characteristics

Symbol	Description	Min	Max	Unit
t _{cycle}	Clock Cycle Time	300		ns
t _{AS}	Address Setup Time	10		ns
t _{AH}	Address Hold Time	0		ns
t _{DSW}	Write Data Setup Time	40		ns
t _{DHW}	Write Data Hold Time	7		ns
t _{DHR}	Read Data Hold Time	20		ns
t _{OH}	Output Disable Time	-	70	ns
t _{ACC}	Access Time	-	140	ns
	Chip Select Low Pulse Width (Read)	120		ns
PW _{CSL}	Chip Select Low Pulse Width (Write)	60		ns
	Chip Select High Pulse Width (Read)	60		ns
PW _{CSH}	Chip Select High Pulse Width (Write)			ns
t _R	Rise Time	-		ns
t _F	Fall Time			

* (V_{DD} - V_{SS} = 2.4V to 2.6V, V_{DDIO} = 1.65V, V_{CI} = 3.3V, T_a = 25°C)

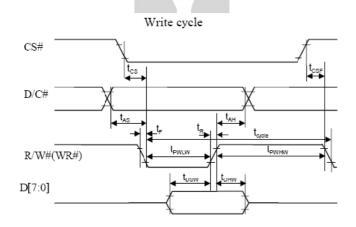


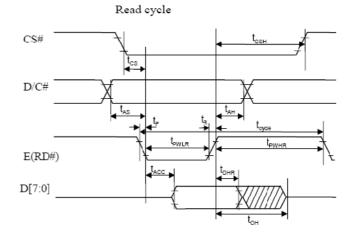


80XX-Series MPU Parallel Interface Timing Characteristics:

Symbol	Description	Min	Max	Unit
t _{cycle}	Clock Cycle Time	300	-	ns
t _{AS}	Address Setup Time	10	-	ns
t _{AH}	Address Hold Time	0	-	ns
t _{DSW}	Write Data Setup Time	40	-	ns
t _{DHW}	Write Data Hold Time	7	-	ns
t _{DHR}	Read Data Hold Time	20	-	ns
t _{OH}	Output Disable Time	-	70	ns
t _{ACC}	Access Time	-	140	ns
t _{PWLR}	Read Low Time	150	-	ns
t _{PWLW}	Write Low Time	60	-	ns
t _{PWHR}	Read High Time	60	-	ns
t _{PWHW}	Write High Time	60	-	ns
t _{CS}	Chip Select Setup Time	0	-	ns
t _{CSH}	Chip Select Hold Time to Read Signal	0	-	ns
t _{CSF}	Chip Select Hold Time	20	-	ns
t _R	Rise Time	-	-	ns
t _F	Fall Time	-	-	ns

* (V_{DD} - V_{SS} = 2.4V to 2.6V, V_{DDIO} = 1.65V, V_{CI} = 3.3V, T_a = 25°C)



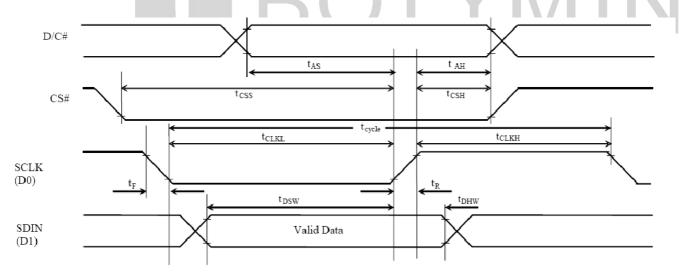


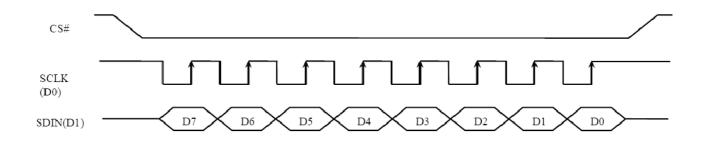


Serial Interface Timing Characteristics: (4-wire serial)

Symbol	Description	Min	Max	Unit
t _{cycle}	Clock Cycle Time	100	-	ns
t _{AS}	Address Setup Time	15	-	ns
t _{AH}	Address Hold Time	15	-	ns
t _{CSS}	Chip Select Setup Time	20	-	ns
t _{CSH}	Chip Select Hold Time	10	-	ns
t _{DSW}	Write Data Setup Time	15	-	ns
t _{DHW}	Write Data Hold Time	15	-	ns
t _{CLKL}	Clock Low Time	20	-	ns
t _{CLKH}	Clock High Time	20	-	ns
t _R	Rise Time	-	15	ns
t _F	Fall Time	-	15	ns

* (V_{DD} - V_{SS} = 2.4V to 2.6V, V_{DDIO} = 1.65V, V_{CI} = 3.3V, T_a = 25°C)



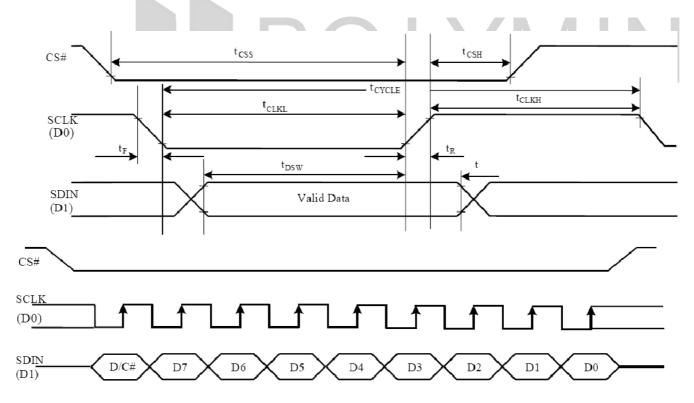




Serial Interface Timing Characteristics: (3-wire Serial)

Symbol	Description	Min	Max	Unit
t _{cycle}	Clock Cycle Time	100	-	ns
t _{CSS}	Chip Select Setup Time	20	-	ns
t _{CSH}	Chip Select Hold Time	10	-	ns
t _{DSW}	Write Data Setup Time	15	-	ns
t _{DHW}	Write Data Hold Time	15	-	ns
t _{CLKL}	Clock Low Time	20	-	ns
t _{CLKH}	Clock High Time	20	-	ns
t _R	Rise Time	-	15	ns
t _F	Fall Time	-	15	ns

* (V_{DD} - V_{SS} = 2.4 V to 2.6 V, V_{DDIO} = 1.65 V, V_{CI} = 3.3 V, T_a = 25 °C)



9.2 Display Control Instruction

Command table refer to IC spec.: SSD1322

10. Quality Assurance

10.1 Inspection conditions

1. The inspection and meaurement are performed under the following conditions,

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- 2. unless otherwise specified.
- 3. Temperature: 25±5℃
- 4. Humidity: 50±10%R.H.
- 5. Distance between the panel and eyes of the inspector \geq 30cm

10.2 Inspection Parameters

Severity	Inspection Item	Defect	Remark	
		(1) Non-displaying		
	1 Panol	(2) Line defects		
		(3) Malfunction		
Major		(4) Glass cracked		
Defect	2 Film	(1) Film dimension out of	Can not be	
	2.1 1111	specification	assembled	
	3 Dimension	(1) Outline dimension out		
	3. Dimension	of specification		
		(1) Glass scratch		
	1. Panel	(2) Glass cutting NG		
		(3) Glass chip		
		(1) Polarizer scratch	Appeorance	
Minor	2. Polarizer	(2) Stains on surface	Appearance	
Defect		(3) Polarizer bubbles	defect	
		(1) Dim spot 、	ueleci	
	3. Displaying	Bright spot 🗸 dust		
		(1) Damage		
	4. (1011)	(2) Foreign material		
	Minor	Major Defect 2. Film 3. Dimension 1. Panel Minor 2. Polarizer	Major 1. Panel (1) Non-displaying Major (2) Line defects Defect (3) Malfunction 2. Film (1) Film dimension out of specification 3. Dimension (1) Outline dimension out of specification 3. Dimension (1) Glass scratch 1. Panel (2) Glass cutting NG (3) Glass chip (1) Polarizer scratch 2. Polarizer (3) Polarizer bubbles 3. Displaying (1) Dim spot ` 3. Displaying (1) Dim spot `	Major 1. Panel (1) Non-displaying Major (2) Line defects Defect (3) Malfunction 2. Film (1) Film dimension out of specification 3. Dimension (1) Outline dimension out of specification 3. Dimension (1) Outline dimension out of specification 4. Panel (2) Glass cutting NG (3) Glass chip (1) Polarizer scratch 2. Polarizer (1) Polarizer bubbles 3. Displaying (1) Dim spot ` 3. Displaying (1) Dim spot ` dust

Description		Criterion		AQL	
1. Glass scratch	$\begin{tabular}{c} Width (mm) \\ W & \\ W & \leq 0.03 \\ 0.03 & \\ W & \leq 0.05 \\ 0.05 & \\ W & \\ beyond A.A. \\ \end{tabular}$	Length (mm) L Ignore L≦3 	number of pieces permitted Ignore 3 None Ignore	Minor	
2. Polarizer bubble	$\begin{array}{c} \text{Size} \\ \Phi \leqq 0.2 \\ 0.2 < \Phi \leqq 0.5 \\ 0.5 < \Phi \\ \text{beyond A.A.} \end{array}$	number pieces perr Ignor 2 0 Ignor	<u>mitted</u> e	Minor	
3. Dimming spot 、 Lighting spot 、 Dust	average $D \leq 0.1$ $0.1 < D \leq 0.15$ $0.1 < D \leq 0.2$ $0.2 < D$ beyond A.A. D =(long diametePixel off is not alloced	1 0 Ignord r + short diame	e	Minor	



10.3 WARRANTY POLICY

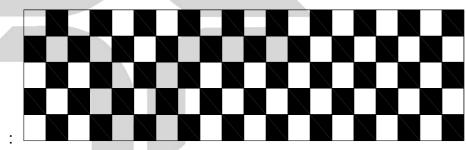
Bolymin . Will provide one-year warranty for the products only if under specification operating conditions.

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 30K hours.
- 10.4.2 Test Condition:
 - 10.4.2.1 Supply Voltage: Vcc=15V
 - 10.4.2.2 Luminance: <80 cd/m²
 - 10.4.2.3 Operation temperature and humidity:<25 $^{\circ}$ C 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℃, 240hrs	
2	High temp. (Operation)	70℃, 120hrs	
3	Low temp. (Operation)	-40℃, 120hrs	
4	High temp. / High. humidity (Operation)	60℃, 90%RH, 120hrs	
5	Thermal shock(Non-operation)	-40℃ ~85℃ (-40℃ /30min; transit /3min; 85℃ /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.

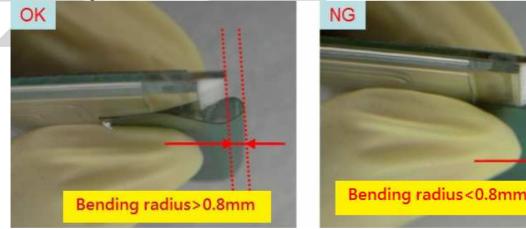
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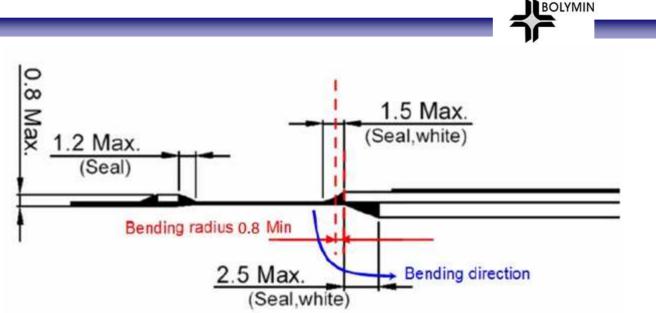
12.3 The OLED module is an electronic component and is subject to damage caused by Electro Static

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

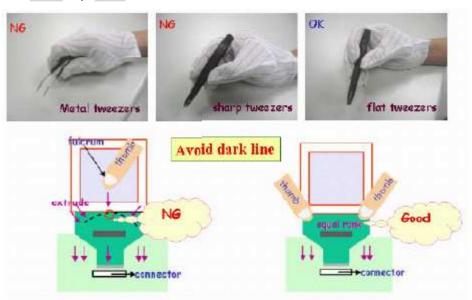




12.5 Avoid bending the film at IC bonding area.(>1.5mm)(this could damage the ILB bonding)



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

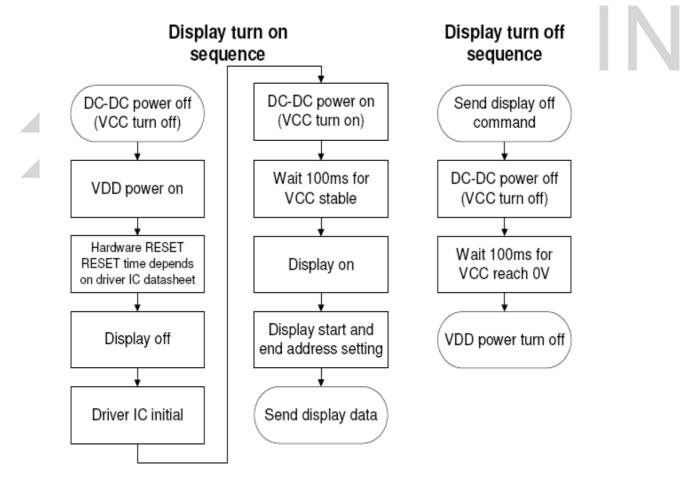
It is extremely important to design and operate the panel using the settings listed in the specification. This includes voltage, current, frame rate, duty cycle... etc. Operation of the OLED outside the specified range in the specification should be entirely avoided to ensure proper operation of the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

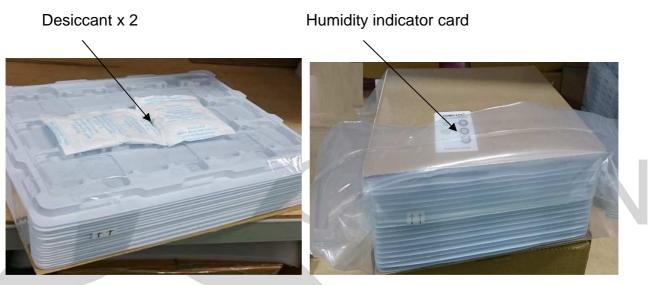


14. Precautions for Storage

Although the storage conditions and guarantee period are indicated in the specification, it is advisable to store the packed cartons or packages at $23^{\circ}C \pm 5^{\circ}C$, $55\% \pm 10\%$ 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.

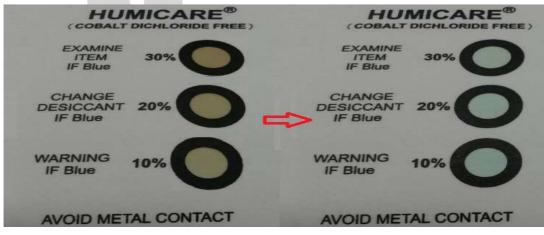
Note (A):

Vacuum Packaging



Humidity indicator card

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



The OLED module would be decayed due to humidity, please keep the environment dry whenever in the operating or storage.