双葉電子工業株式会社
エレクトロニックコンポーネンツ
事業センター
ELECTRONIC COMPONENTS
BUSINESS CENTER

形名　Type No. ELW2106GAP

1. 適用範囲　Scope

この仕様書は、双葉電子工業株式会社が納入するOLEDの仕様について規定する。
This specification applies to OLEDs to be supplied by Futaba Corporation.

本OLED製品はRiT display Corporationにて製造され、RiT display Corporationにおける製品名は以下となる。
RiT display Corporation 製品名：9OL99F5601000
This OLED product is manufactured by RiT display, and the product name is as follow.
RiT display Corporation product name：9OL99F5601000

2. 一般規定　General Specifications

2.1 発行年月日より 2ヶ月間以内に返却無き場合、当仕様書は受領されたものとする。
When there is no return within two months from the date of the issue, this product specification will be recognized as granted.

2.2 本仕様書は、納入側より最終ロットが出荷された翌月より起算し、1年後に効力を停止するものとする。
The specification terminates 1 year after the month following the last lot delivery.

2.3 この製品は汎用品である為、仕様が予告無しに変更されることがある。
This specification is subject to change without notice , because this product is a general - purpose.

2.4 Page4の"2. WARRANTY" にて保証期限に関する記載があるが、本仕様書では以下の内容にて保証とする。
直射日光、蛍光灯の光が当たらない場での同項記載の保管条件、且つ弊社減圧梱包に入れた状態においては納入後12ヶ月を保証期限とする。
Although there is a description of the warranty period in the item "2.WARRANTY" below, we guarantee it as follows.
The warranty period is 12 months after delivery if the product is stored in Futaba de-gas packing under the storage conditions described in the same section, where it is not exposed to direct sunlight or fluorescent light.

2.5 本仕様書に記載の製品は、一般電子機器（AV機器、通信機器、家電機器、アミューズメント機器、コンピュータ機器、パーソナル機器、事務機器、計測機器、産業用ロボット）に汎用標準的な用途で使用され、また、当該一般電子機器が、通常の操作、使用方法で用いられることを意図している。
高度な安全性や信頼性が必要とされ、または機器の故障、誤動作、不具合が人への生命、身体や財産等に損害を及ぼす恐れがあり、もしくは社会的影響が甚大となる恐れのある以下の用途（以下特定用途）への適合性、性能発揮、品質を保証しないものとする。
本仕様書の範囲、条件を越え、または特定用途に使用されたことにより発生した損害等については、その責任を負わないものとする。
本仕様書の範囲、条件を超え、または特定用途での使用を予定されている場合、事前に弊社窓口までご連絡の上、お客さまの用途に合わせ、本仕様書掲載の仕様とは別の仕様について協議するものとする。

The products listed on this specification sheet are intended for use in general electronic equipment (AV equipment, telecommunications equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal operation and use condition.
The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to society, person or property.
Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this specification sheet.
If you intend to use the products in the applications listed below or if you have special requirements exceeding the range or conditions set forth in this specification, please contact us.

①航空、宇宙機器	Aerospace/Aviation Equipment
②輸送用機器（自動車、電車、船舶等）	Transportation Equipment (Cars, Electric Trains, Ships, etc.)
③医療用機器	Medical Equipment
④発電制御用機器	Power-generation Control Equipment
⑤原子力関係機器	Atomic energy-related Equipment
⑥海底機器	Seabed Equipment
⑦交通機関制御機器	Transportation Control Equipment
⑧公共性の高い情報処理機器	Public Information-processing Equipment
⑨軍事用機器	Military Equipment
⑩電熱用品、燃焼機器	Electric Heating Apparatus, Burning Equipment
⑪防災、防犯機器	Disaster Prevention/Crime Prevention Equipment
⑫各種安全装置	Safety Equipment
⑬その他特定用途と認められる用途	Other applications that are not considered general-purpose applications.

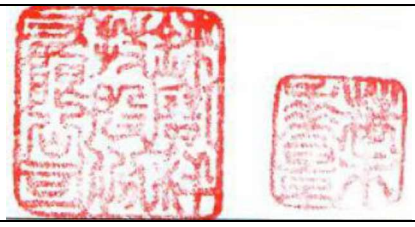
なお、本製品を使用する機器の設計にあたっては、当該機器の使用用途および態様に応じた保護回路・装置の確保やバックアップ回路を設ける等すること。
When designing your equipment even for general-purpose applications, you are kindly requested to take into consideration securing protection circuit/device or providing backup circuits in your equipment.

2.6 本仕様書に疑義を生じた場合、新たな問題が発生した場合、改廃・廃止の必要を認めた場合には、納入者と購入者の双方の話し合いにより誠意をもって解決にあたるものとする。使用条件の変更又は用途の変更を提起する場合は両者が協議し、必要に応じて仕様の見直しを行うものとする。
When the reservation is caused in this specifications, a new problem occurs or either change or abolition are admitted, both suppliers and purchasers are to solve those by talking sincerely. When the change in use conditions or change in usage are raised, both confer and it is assumed to review the specification if necessary.

Preliminary Specification

PRODUCT NUMBER: **9OL99F5601000**
PRODUCT DESCRIPTION: **RGC21256064WR016**

CUSTOMER			
Futaba Coporation			
APPROVED BY			
平賀	中山	廣田	彬林印弘
DATE: 2023.04.26			

RITDISPLAY CORP. APPROVED


REVISION RECORD

REV.	REVISION DESCRIPTION	REV. DATE	REMARK
X01	INITIAL RELEASE	2023. 02. 16	
X02	■ Modify the WARRANTY ■ Modify the FEATURES ■ Modify the Module Weight ■ Modify the MAXIMUM RATINGS ■ Modify the ELECTRICAL CHARACTERISTICS ■ Modify the LIFETIME SPECIFICATION ■ Modify the INTERFACE ■ Modify the POWER ON / OFF SEQUENCE & APPLICATION CIRCUIT ■ Modify the RELIABILITY TEST CONDITIONS ■ Modify the SPECIFICATION FOR QUALITY CHECK ■ Modify the Storage ■ Modify the Minimum Order Quantity ■ Modify the MEASUREMENT APPARATUS	2023. 04. 12	Page 4~8、10~18、25~29、40

CONTENTS

1. SCOPE

The purpose of this specification is to define the general provisions and quality requirements that apply to the supply of display cells manufactured by RiTdisplay. This document, together with the Module Assembly Drawing, is the highest-level specification for this product. It describes the product, identifies supporting documents and contains specifications, which are either not addressed, or are exceptions to the supporting documents.

2. WARRANTY

RiTdisplay warrants that the products delivered pursuant to this specification (or order) will conform to the agreed specifications for twelve (12) months from the shipping date ("Warranty Period"). RiTdisplay is obligated to repair or replace the products which are found to be defective or inconsistent with the specifications during the Warranty Period without charge, on condition that the products are stored in the original packages at -5°C~+35°C, 30%~65%RH or used as the conditions specified in the specifications.

Nevertheless, RiTdisplay is not obligated to repair or replace the products without charge if the defects or inconsistency are caused by the force majeure or the reckless behaviors of the customer.

After the Warranty Period, all repairs or replacements of the products are subject to charge.

3. FEATURES

- Small molecular organic light emitting diode.
- Color : White
- Panel matrix : 256x64
- Driver IC : SSD1362
- Extremely thin thickness for best mechanism design : 1.339 mm (with Polarizer)
- High contrast : 10,000:1
- Serial Peripheral Interface
- Strong environmental resistance.
- Wide range of operating temperature: -40 to 80°C.
- Circular Polarizer .

4. MECHANICAL DATA

NO	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	256(W) x 64(H)	dot
2	Dot Size	0.174 (W) x 0.17 (H)	mm^2
3	Dot Pitch	0.198(W) x 0.194(H)	mm^2
4	Aperture Rate	77	%
5	Active Area	50.664(W) x 12.392 (H)	mm^2
6	Panel Size	60.6 (W) x 17.5 (H)	mm^2
7	Module Size	95.6 (W) x17.5(H) x 1.339 (D)	mm^3
8	Diagonal A/A size	2.05	inch
9	Module Weight	2.83 ± 10%	gram

5. MAXIMUM RATINGS

ITEM	MIN	MAX	UNIT	Condition	Remark
Supply Voltage (V_{CI})	-0.3	5.5	V	Ta = 25°C	IC maximum rating
Supply Voltage (V_{CC})	-0.5	18.5	V	Ta = 25°C	IC maximum rating
Signal Input Voltage(Vi)	-0.3	VCI+0.3	V		
Operating Temp.	-40	80	°C	-	-
Storage Temp	-40	85	°C	-	-

Note:

Maximum ratings are those values beyond which damages to the OLED module may occur. The OLED functional operation should be restricted to the limits in the section 6. Electrical Characteristics tables.

6. ELECTRICAL CHARACTERISTICS

6.1 D.C ELECTRICAL CHARACTERISTICS

SYMBOL	PARAMETER	TEST CONDITION	MIN	TYP	MAX	UNIT
V_{CC}	Operating Voltage (for OLED panel)	Ta = 25°C	15.5	16.5	17.5	V
V_{CI}	Logic Supply Voltage	Ta = 25°C	1.65	3.0	3.5	V
V_{IH}	High Logic Input Level		0.8* V_{CI}	-	V_{CI}	V
V_{IL}	Low Logic Input Level		GND	-	0.2*V_{CI}	V

6.2 ELECTRO-OPTICAL CHARACTERISTICS

PANEL ELECTRICAL SPECIFICATIONS

PARAMETER	MIN	TYP.	MAX	UNITS	COMMENTS
Normal mode current (ICC)	-	19.5	26	mA	50% pixels on (1)
	-	350	680	uA	All pixels off(1)
Normal mode current (ICI)	-	345	475	uA	50% pixels on (1)
	-	310	426	uA	All pixels off(1)
ICC Standby mode current	-	-	10	uA	Standby mode Current (2)
ICI Standby mode current	-	-	60	uA	Standby mode Current(2)
Normal Luminance	160	200	-	cd/m^2	Display Average
CIEx (White)	0.26	0.30	0.34		x, y (CIE 1931)
CIEy (White)	0.29	0.33	0.37		
Dark Room Contrast	10,000:1				

(1) Normal mode condition :

- V_{CC} = 16.5V
- Contrast setting : 0x87
- Duty setting : 1/64
- Min: 100Hz

(2) Standby mode condition :

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

(3) Wake up condition :

When send 0xAF command OLED will be turned on.

7. LIFETIME SPECIFICATION

ITEM	MIN	UNIT	Condition	Remark
Life Time (Operation)	10,000	Hrs	200 cd/m², 50% alternating checkerboard	Note (1)
Life Time (Storage)	10	Years	50% Pixels shrinkage time	

Note:

(A) Under V_{CC} = 16.5V, Ta = 25°C, 50% RH.

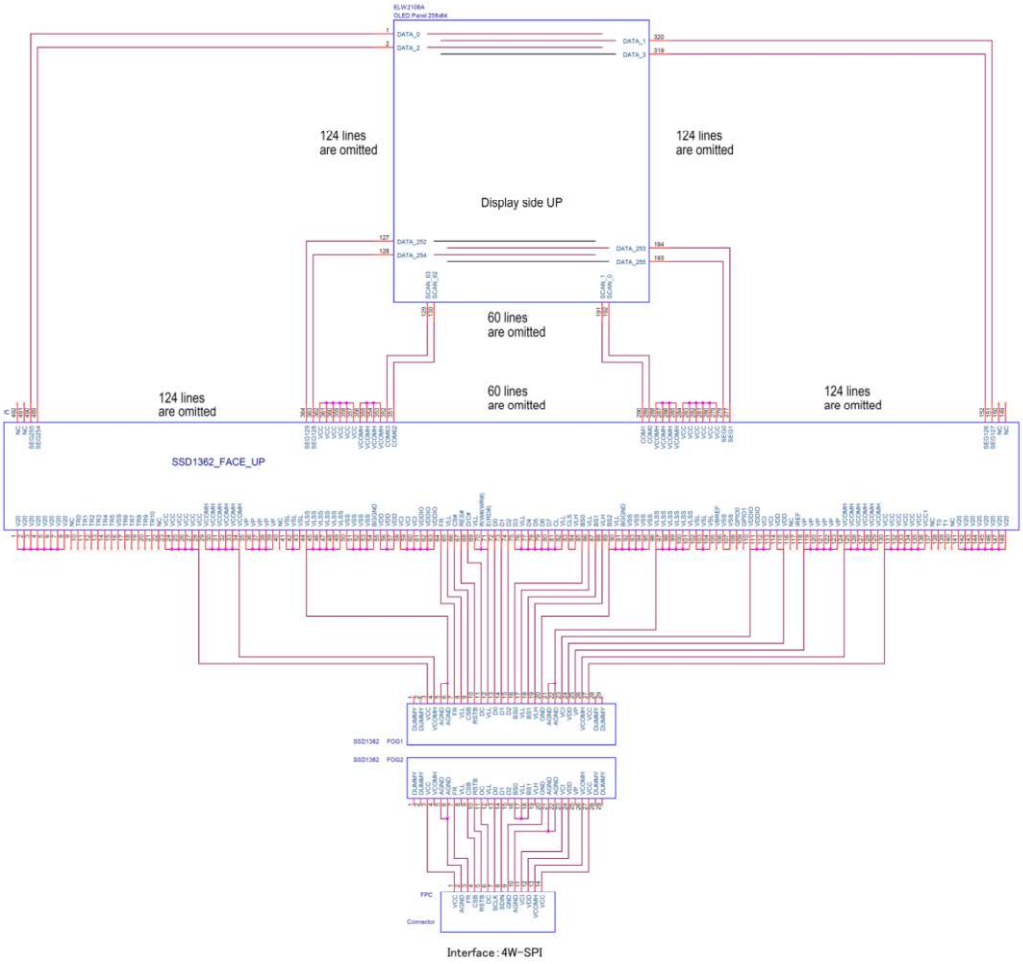
(B) Life time is defined the amount of time when the luminance has decayed to less than 50% of the initial measured luminance.

(1) Setting of 200 cd/m^2:

- Contrast setting : 0x87
- Duty setting : 1/64

8. INTERFACE

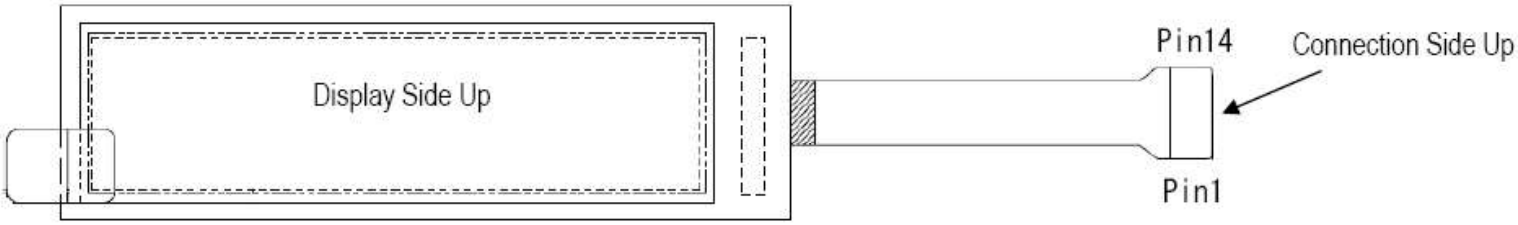
8.1PANEL LAYOUT DIAGRAM



8.2 PIN ASSIGNMENTS

I:Input, O:Output, P:Power

PIN No	Pin Name	Function Description	I/O
1	VCC	OLED Driving Voltage	P
2	AGND	Analog Ground	P
3	FR	Synchronization Signal	O
4	CSB	Chip Select	I
5	RSTB	Reset	I
6	DC	Data/Command Selection	I
7	SCLK	Serial Clock	I
8	SDIN	Data Input	I
9	GND	Ground Pin	P
10	AGND	Analog Ground	P
11	VCI	Logic Power Voltage	P
12	VDD	Core Voltage	P
13	VCOMH	COMH Voltage	P
14	VCC	OLED Driving Voltage	P



8.3 PIXEL DATA OUTPUT MODE

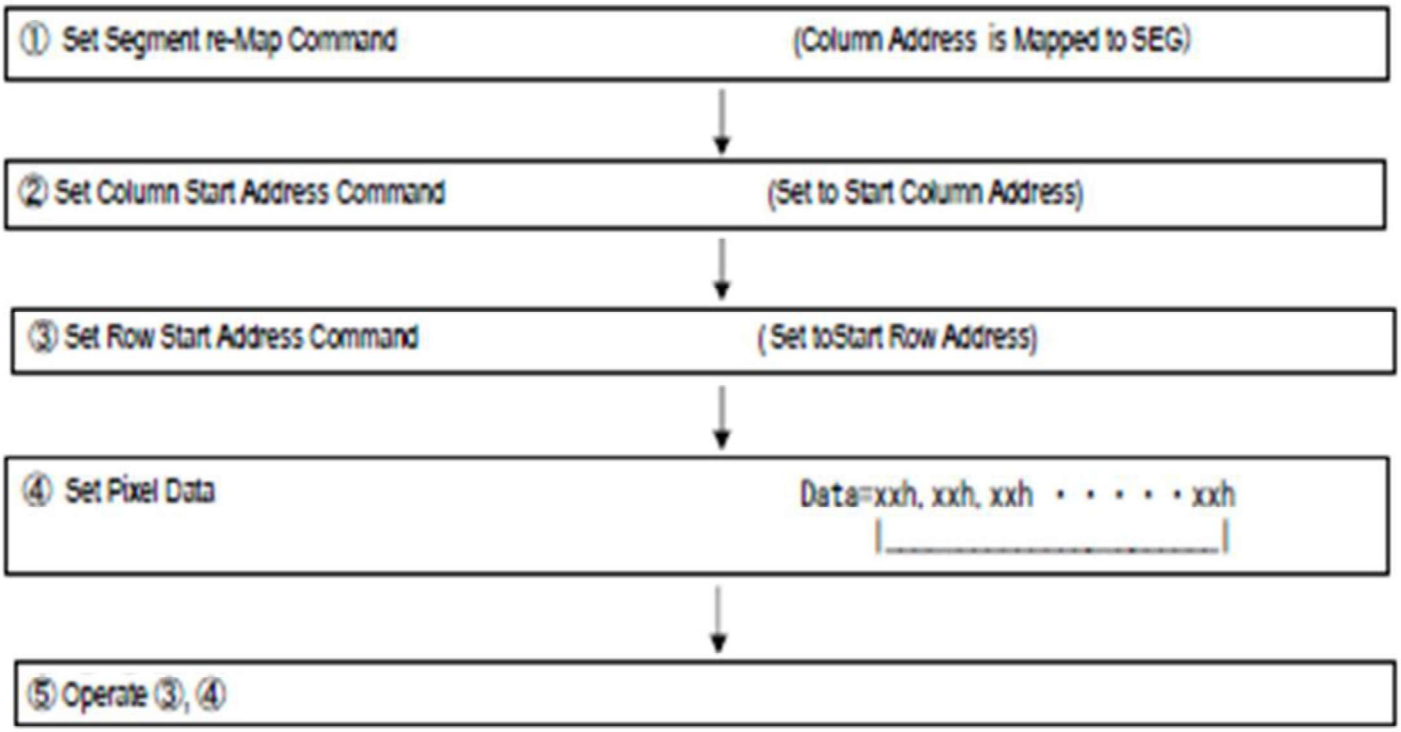
8.3.1 Graphic Display Data RAM(GDDRAM)

The GDDRAM is a bit mapped static RAM holding the bit pattern to be displayed. The RAM size is 256 x 64 x 4bits.

For mechanical flexibility, re-mapping on both Segment and Common outputs can be selected by software.

		SEG0	SEG1	SEG2	SEG3		SEG252	SEG253	SEG254	SEG255
		00		01			7E		7F	
COM0	00	D0[3:0]	D0[7:4]	D1[3:0]	D1[7:4]		D126[3:0]	D126[7:4]	D127[3:0]	D127[7:4]
COM1	01	D128[3:0]	D128[7:4]	D129[3:0]	D129[7:4]		D254[3:0]	D254[7:4]	D255[3:0]	D255[7:4]
I	I									
COM62	3E	D7936[3:0]	D7936[7:4]	D7937[3:0]	D7937[7:4]		D8062[3:0]	D8062[7:4]	D8063[3:0]	D8063[7:4]
COM63	3F	D8064[3:0]	D8064[7:4]	D8065[3:0]	D8065[7:4]		D8190[3:0]	D8190[7:4]	D8191[3:0]	D8191[7:4]

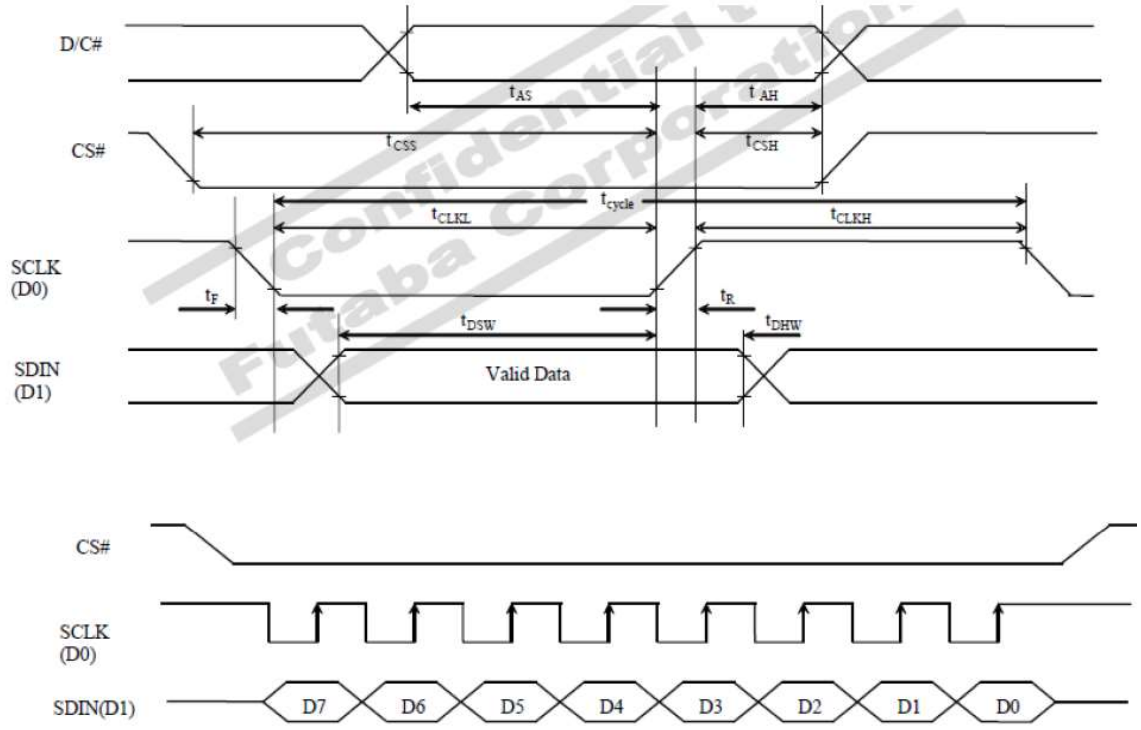
8.3.2 Memory Writing Sequence



8.4 SERIAL INTERFACE TIMING

V_{CI} - V_{SS} = 1.65V to 3.5V (T_A = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	100	-	-	ns
t_{AS}	Address Setup Time	15	-	-	ns
t_{AH}	Address Hold Time	40	-	-	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	30	-	-	ns
t_{CLKL}	Clock Low Time	25	-	-	ns
t_{CLKH}	Clock High Time	20	-	-	ns
t_R	Rise Time	-	-	15	ns
t_F	Fall Time	-	-	15	ns



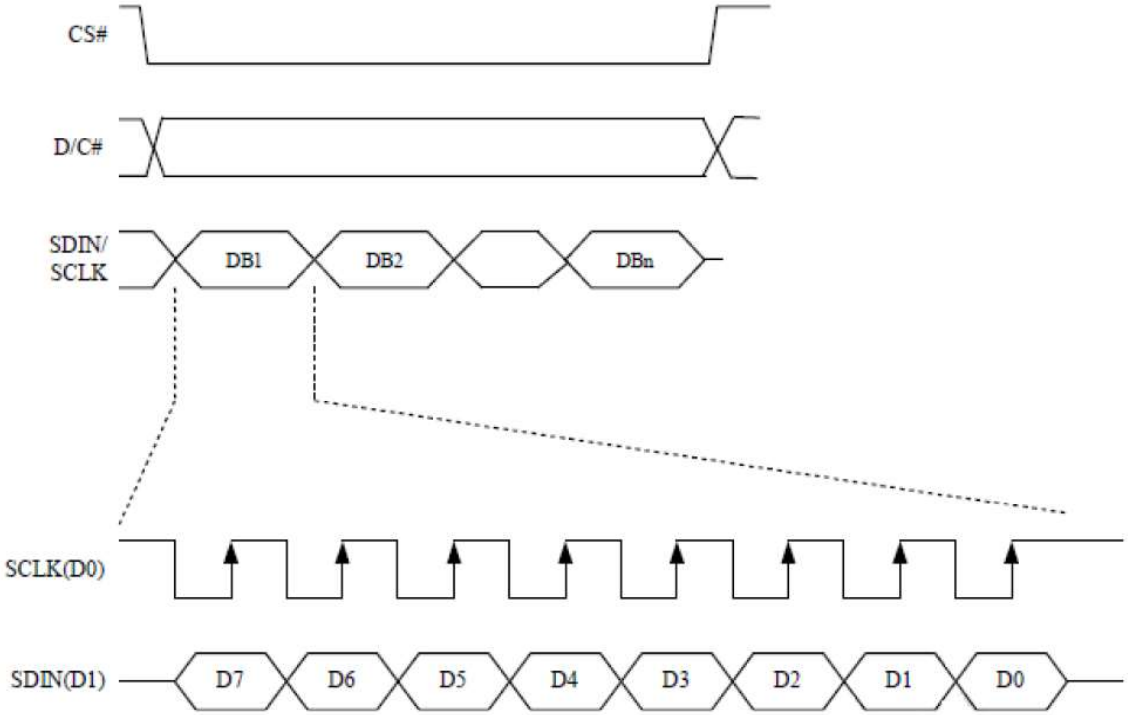
8.5. SERIAL INTERFACE CONTROL SPECIFICATION

MPU Serial Interface (4-wire SPI)

If D/C# pin is LOW, the input at D7 to D0 is interpreted as command.

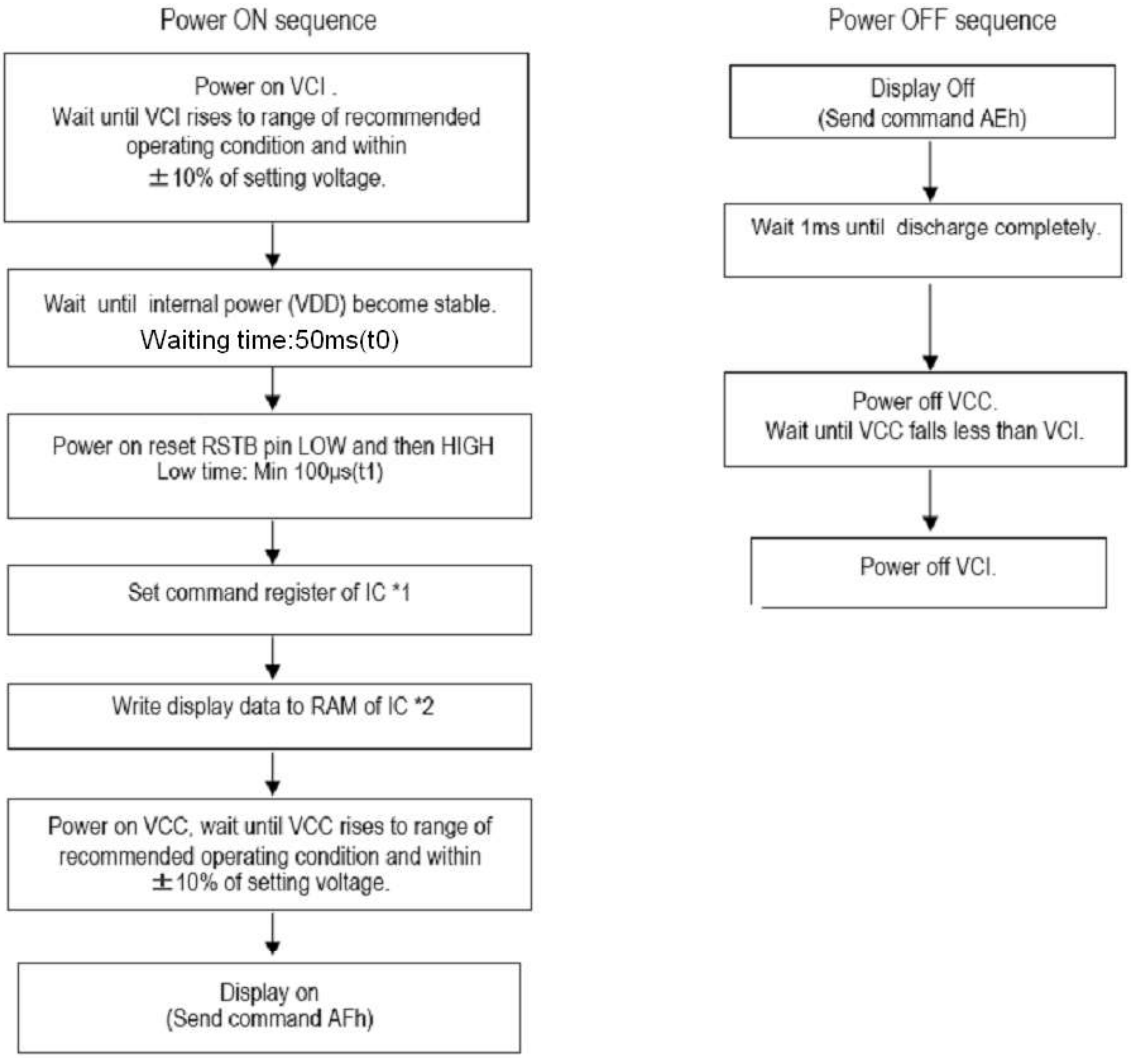
If D/C# pin is HIGH, the input at D7 to D0 is interpreted as parameter/data.

Set CS# "L" when the command, parameter/data is sent.



9. POWER ON / OFF SEQUENCE & APPLICATION CIRCUIT

9.1 POWER ON/OFF SEQUENCE & DISPLAY ON/OFF SEQUENCE



Notice:

*1) Refer to 9.3) Example of Software Configuration.

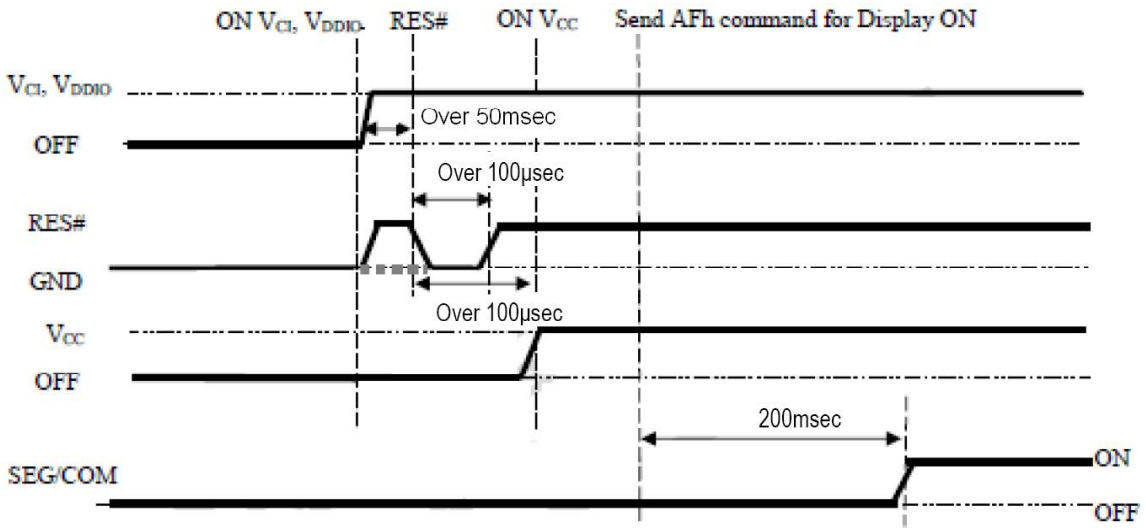
*2) Refer to 8.3) Pixel Data Output Mode.

Keep Power ON/OFF Sequence & Display ON/OFF Sequence, otherwise module would break down.

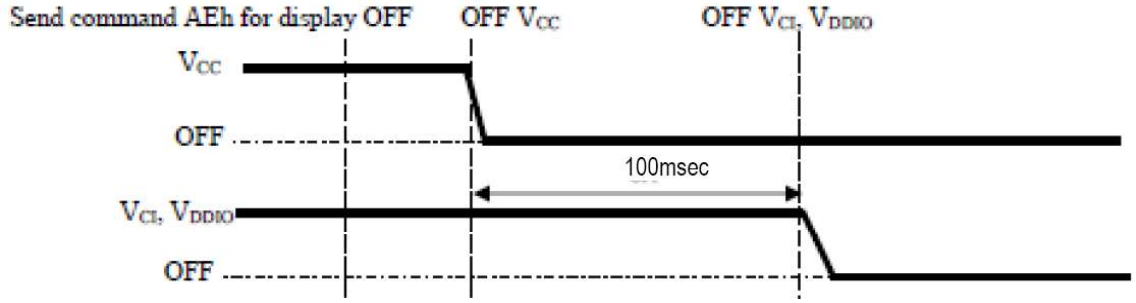
9.2 POWER ON/OFF SEQUENCE & DISPLAY ON/OFF SEQUENCE

（Continued)

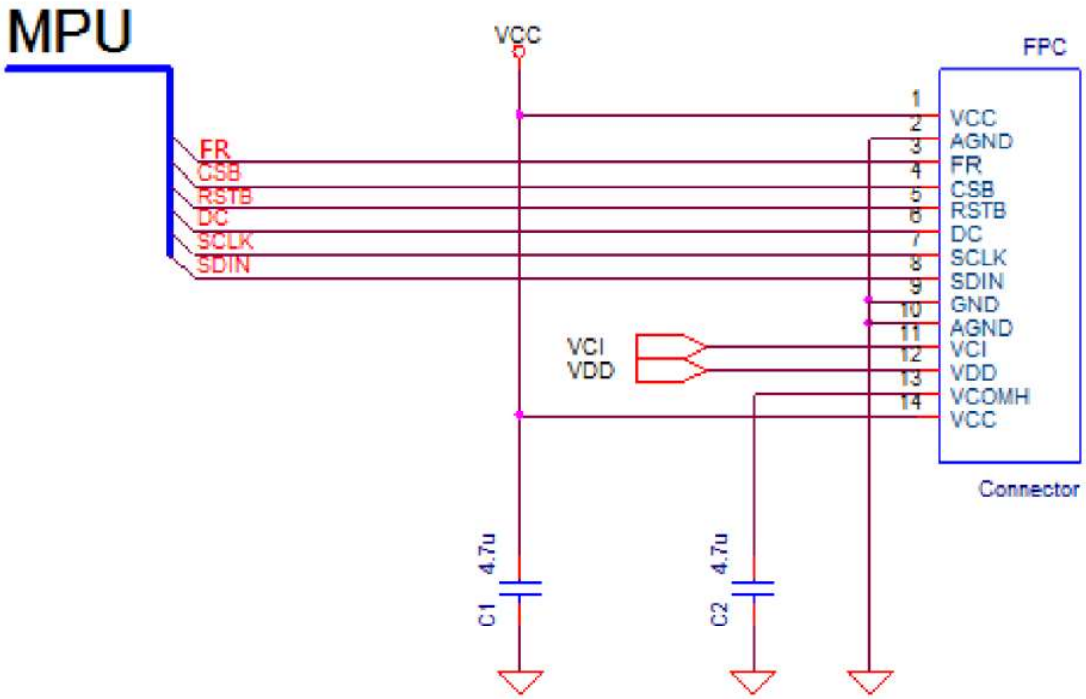
Power ON / Display ON Sequence



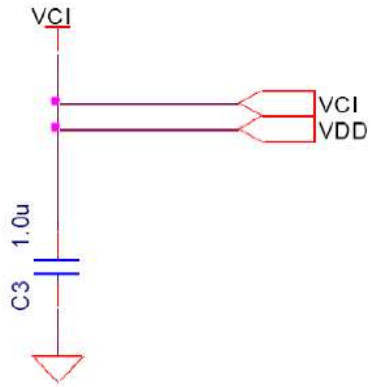
Power OFF / Display OFF Sequence



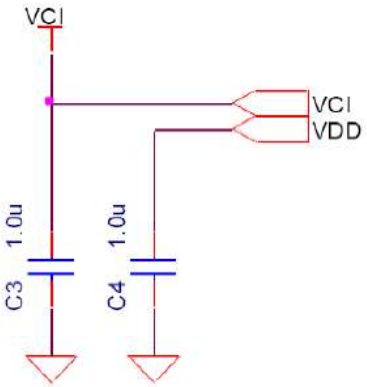
9.3 RECOMMENDED CIRCUIT



※VCI≦2.6V



※VCI＞2.6V



9.4 EXAMPLE OF SOFTWARE CONFIGURATION

Set Contrast Control	81h, 87h
Set segment re-map	A0h, 53h
Set display start line	A1h, 00h
Set display offset	A2h, 00h
Set normal display mode	A4h
Set MUX ratio	A8h, 3Fh
Set external / internal VDD regulator mode	ABh, 00h (VCI＜2. 6V) ABh, 01h (VCI≧2. 6V)
Set IREF Selection	ADh、9Eh
Set phase length of phase1, phase2	B1h, 11h
Set ratio of dividing frequency & oscillation frequency	B3h, F0h
Set gray scale table	B9h
Set pre-charge voltage	BCh, 04h
Set voltage VCOMH	BEh, 05h
Set column address	15h, 00h, 7Fh
Set row address	75h, 00h, 3Fh

10. RELIABILITY TEST CONDITIONS

No.	Items	Specification	Quantity
1	Low temp. (Storage)	-40°C, 240hrs	5
2	Low temp. (Operation)	-40°C, 240hrs	5
3	High temp. (Storage)	+85°C, 240hrs	5
4	High temp. (Operation)	+80°C, 240hrs	5
5	High temp. / High humidity (Storage)	+60°C, 95%RH, 240hrs	5
6	Heat Cycle	-40°C30Min/+85°C 30Min,100 Cycle	5
7	Surge Test	HBM:100pF、1.5kΩ、±1000V MM : 200pF、0kΩ、±200V	5
8	Flexural Strength	Refer to Method of Measuring OLED Panel Flexural Strength Characteristic 25N≦Stregth of the OLED Panel	5
9	Drop Test (Packing)	Height: 80cm Sequence : 1 angle、3 edges and 6 faces Cycles: 10	5 Carton
10	Vibration (Packing)	Frequency : 5~100HZ, 0.75G Logarithm Sweep Time : 2 hrs/axis Test axis : X, Y, Z	5 Carton

Test and measurement conditions

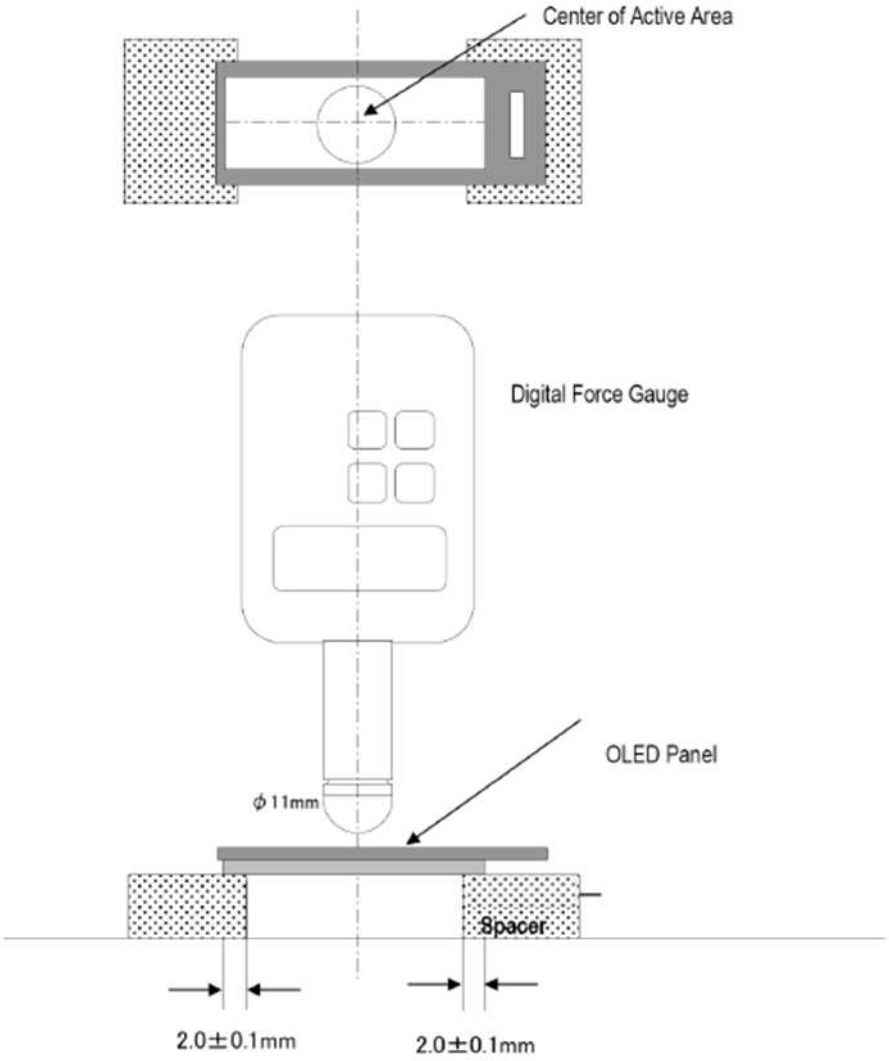
All measurements shall not be started until the specimens attain to temperature stability.

Evaluation criteria

1. The function test is OK.
2. No observable defects.
3. Luminance: > 50% of initial value.

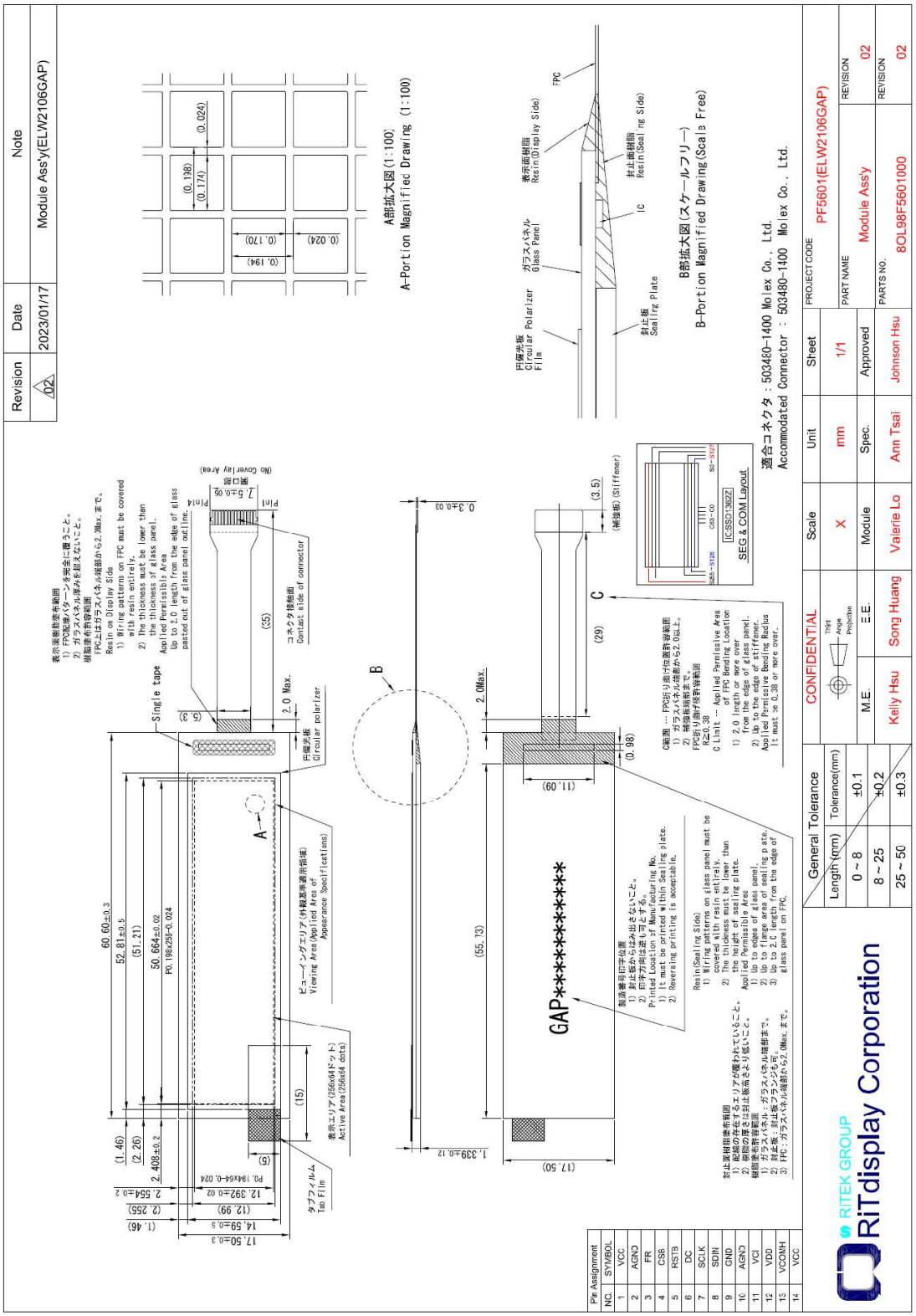
- **Method of Measuring OLED Panel Flexural Strength Characteristic**

  Placing a OLED panel with the sealing plate side down, exerting the load on the center of display side with the metal ball(Φ11mm) , and measure the strength with the digital force gauge when the OLED panel cracks.



11. EXTERNAL DIMENSION

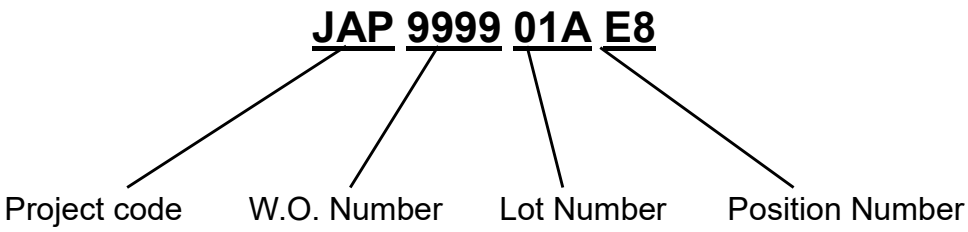
11.1 MODULE ASS'y



11.2 PRODUCTION NUMBER

The production number for the OLED display is as following.

Example :



1.) Project Code

The abbreviation of Futaba's project code

2.) W.O. Number:

0000 ~ 9999 or

000 ~ 999

3.) Lot Number :

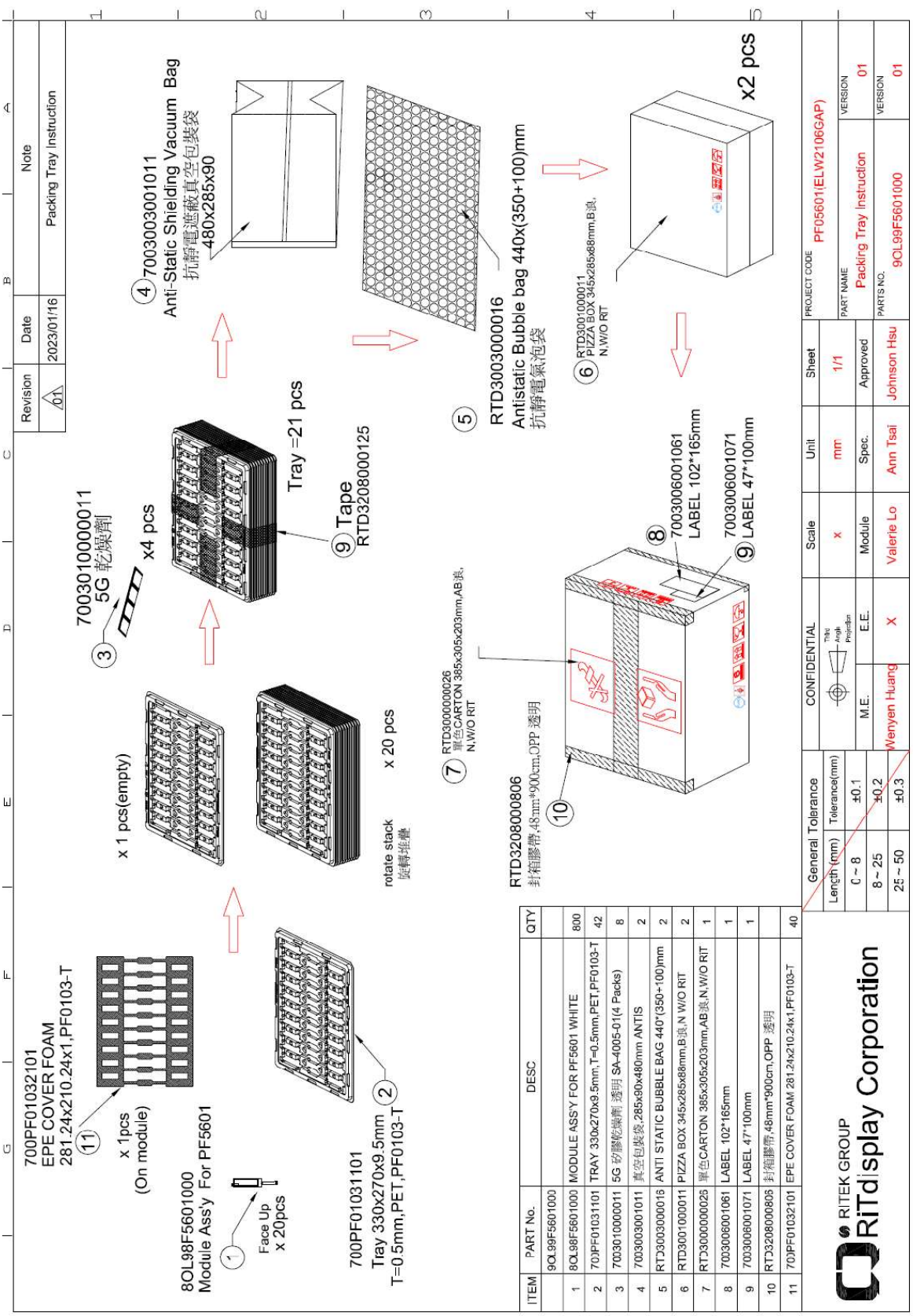
Cassette → 01~99

Sheet Number → A~T

4.) Position Number:

The glass cells are sorted by alphabetical and number order on glass sheet (e.g. A1,A2,A3, B1, B2...etc)

12. PACKING SPECIFICATION



13. OUTGOING INSPECTION PROVISION

1. 抽樣方法 / SAMPLING METHOD

(1) MIL-STD-1916 / 驗證水準 level III / 正常檢驗 / 單次樣品檢驗
MIL-STD-1916 / inspection level III / normal inspection / single sample inspection

(2) 主要缺陷 Level III；次要缺陷 Level II
Major Level III ; Minor Level II

MIL-STD-1916樣本代字對照表							
批量	驗證水準（VL）						
	VII	VI	V	IV	III	II	I
2～170	A	A	A	A	A	A	A
171～288	A	A	A	A	A	A	B
289～544	A	A	A	A	A	B	C
545～960	A	A	A	A	B	C	D
961～1632	A	A	A	B	C	D	E
1633～3072	A	A	B	C	D	E	E
3073～5440	A	B	C	D	E	E	E
5441～9216	B	C	D	E	E	E	E
9217～17408	C	D	E	E	E	E	E
17409～30720	D	E	E	E	E	E	E
≧30721	E	E	E	E	E	E	E

樣本代字 (CL)	驗證水準(VL)							
	T	VII	VI	V	IV	III	II	I
	樣本大小							
A	3072	1280	512	192	80	32	12	5
B	4096	1536	640	256	96	40	16	6
C	5120	2048	768	320	128	48	20	8
D	6144	2560	1024	384	160	64	24	10
E	8192	3072	1280	512	192	80	32	12

2. 檢驗條件 / INSPECTION CONDITION

檢查和測量在下列條件下進行的，除非另有規定。

The inspection and meaurement are performed under the following conditions, unless otherwise specified.

溫度 / Temperature: 25±5°C

濕度 / Humidity: 50±10%R.H.

壓力 / Pressure: 860~1060hPa (mbar)

照度 / Illumination at Appearance Inspection

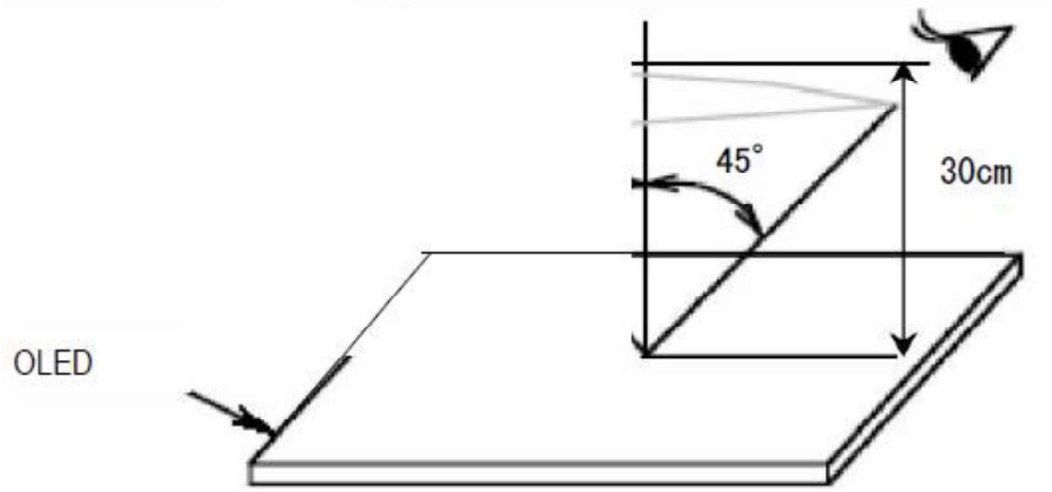
(1.)點亮下/ Lighting Appearance Inspection 20～100 lx

(2.)外觀檢 / Appearance Inspection 1500～5000 lx

(3.)FPC 外觀檢 / Appearance Inspection of FPC 1500～5000 lx

檢驗員拿的面板和眼睛之間的距離 / Distance between the panel and eyes of the inspector≧30cm

檢驗員拿的面板和眼睛之間的角度/ Angle between the panel and eyes of the inspector θ = 45。



3. 品質檢驗規格 / SPECIFICATION FOR QUALITY CHECK

出貨規格 / OUTGOING SPECIFICATION

<table>
<tr><th>項目
Item</th><th>描述
Description</th><th>標準
Criterion</th></tr>
<tr><td>I.顯示檢查
Display
Inspection</td><td>1. 暗點、亮點 、髒污、暗線
Dimming spot、Lighting spot、Dust、Black Line</td><td>1. 點缺陷 Point Defect
<table>
<tr><th>平均直徑
Average diameter
D:(mm)</th><th>容許個數
number of pieces permitted</th></tr>
<tr><td>D ≦0.1</td><td>忽略
Ignore</td></tr>
<tr><td>0.1 ＜ D ≦0.17</td><td>3</td></tr>
<tr><td>0.17 ＜ D</td><td>0</td></tr>
<tr><td>顯示區外
beyond V.A.</td><td>忽略
Ignore</td></tr>
</table>
D=(長邊直徑 + 短邊直徑)/2
D=(long diameter + short diameter)/2
像素暗點是不允許。
Pixel off is not allowed.

2. 線缺陷 Line Defect
<table>
<tr><th>寬
width(mm)
W</th><th>長
length(mm)
L</th><th>容許個數
number of pieces permitted</th></tr>
<tr><td>W≦0.05</td><td>忽略
Ignore</td><td>忽略
Ignore</td></tr>
<tr><td>0.05＜ W≦0.1</td><td>L≦2</td><td>3</td></tr>
<tr><td>0.1＜ W</td><td>------</td><td>無
None</td></tr>
<tr><td>顯示區外
beyond V.A.</td><td>------</td><td>忽略
Ignore</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>項目
Item</th><th>描述
Description</th><th>標準
Criterion</th></tr>
<tr><td>I.
顯示檢查
Display Inspection</td><td>2. 亮線、暗線
Bright Line、
Dark Line</td><td>1. 線缺陷 Line Defect
<table>
<tr><td></td><td>容許個數
number of pieces permitted</td></tr>
<tr><td>顯示幕關閉時亮線
Bright Line when all display off.</td><td>0</td></tr>
<tr><td>顯示幕點亮時暗線
Dark Line when all display on.</td><td>0</td></tr>
</table>
2. 亮度差異≧5%是不能接受的。
Luminance Difference≧5% is not acceptable.</td></tr>
<tr><td rowspan="2">II.
外觀檢查
Appearance
Inspection</td><td>1. 偏光片刮傷
Polarizer scratches</td><td>
<table>
<tr><td>寬 / Width (mm)
W</td><td>長 / Length (mm)
L</td><td>容許個數
number of pieces permitted</td></tr>
<tr><td>W≦0.05</td><td>忽略
Ignore</td><td>忽略
Ignore</td></tr>
<tr><td>0.05< W≦0.1</td><td>L≦5</td><td>3</td></tr>
<tr><td>0.1< W</td><td>------</td><td>無
None</td></tr>
<tr><td>顯示區外
beyond V.A.</td><td>------</td><td>忽略
Ignore</td></tr>
</table>
</td></tr>
<tr><td>2. 偏光片表面汙漬
Polarizer stains on the surface</td><td>表面汙漬無法用軟布或類似的清潔物輕輕擦拭去除。
Stains cannot be removed even when wiped lightly with a soft cloth or similar cleaning.</td></tr>
</table>

<table>
<tr><th>項目
Item</th><th>描述
Description</th><th>標準
Criterion</th></tr>
<tr><td rowspan="3">II.
外觀檢查
Appearance
Inspection</td><td>3.偏光板氣泡
Polarizer bubble</td><td>(mm)
<table><tr><th>尺寸
Size</th><th>容許個數
number of pieces permitted</th></tr><tr><td>D≦0.2</td><td>忽略
Ignore</td></tr><tr><td>0.2＜D≦0.5</td><td>3</td></tr><tr><td>0.5＜D</td><td>0</td></tr><tr><td>顯示區外
beyond V.A.</td><td>忽略
gnore</td></tr></table>D=(長邊直徑 + 短邊直徑)/2
D=(long diameter + short diameter)/2
像素暗點是不允許。
Pixel off is not allowed</td></tr>
<tr><td>4.FPC 上的污垢、刮傷、彎曲、FPC 凹痕
Dirt, Scratch , Bend ,Dent for FPC</td><td>不可影響顯示功能
Pretermission when no influence on Display Function.</td></tr>
<tr><td>5.玻璃崩邊、崩角
Glass Chipping / Cracking</td><td>不可影響顯示功能
Pretermission when no influence on Display Function.</td></tr>
</table>

14. Minimum Order Quantity

5600pcs : 20(pcs/tray) * 40(tray/box)*7(box) = 5600pcs

15.Country of Origin / Production Site

TAIWAN / TAIWAN

16.Efforts on Environment

A. The product complies for Halogen free , RoHS ,REACH requirements.
B. Raw materials are meet the environmental requirements during production process of products and there is no harmful substances to the environment are used.
C. Environmental hazardous substances will be checked regularly by RiTdisplay.

17. APPENDIXES

APPENDIX 1: DEFINITIONS

A. DEFINITION OF CHROMATICITY COORDINATE

The chromaticity coordinate is defined as the coordinate value on the CIE 1931 color chart for R, G, B, W.

B. DEFINITION OF CONTRAST RATIO

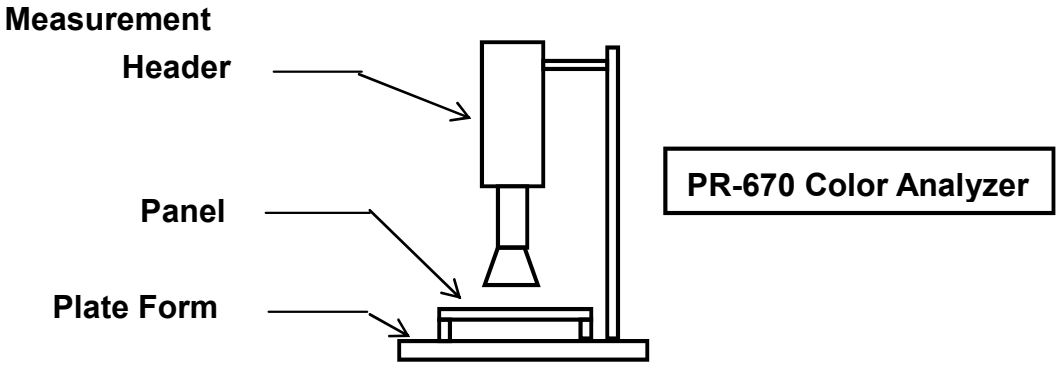
The contrast ratio is defined as the following formula:

$$\text{Contrast Ratio} = \frac{\text{Luminance of all pixels on measurement}}{\text{Luminance of all pixels off measurement}}$$

APPENDIX 2: MEASUREMENT APPARATUS

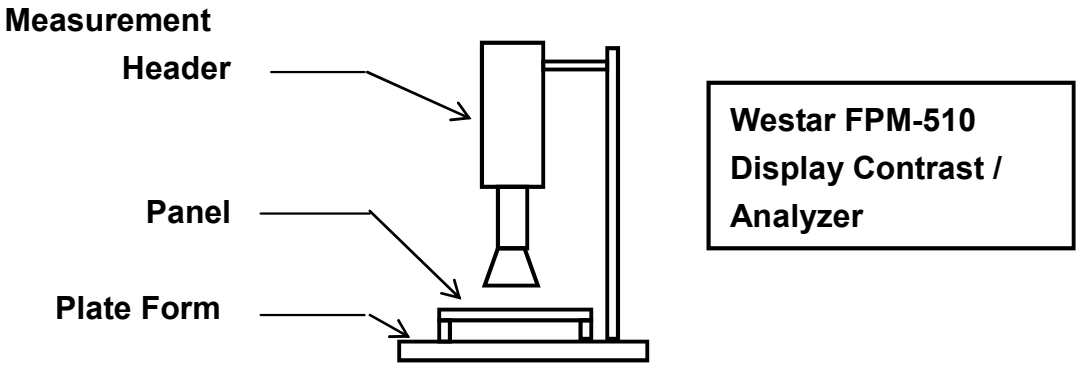
A. LUMINANCE/COLOR COORDINATE

PHOTO RESEARCH PR-670

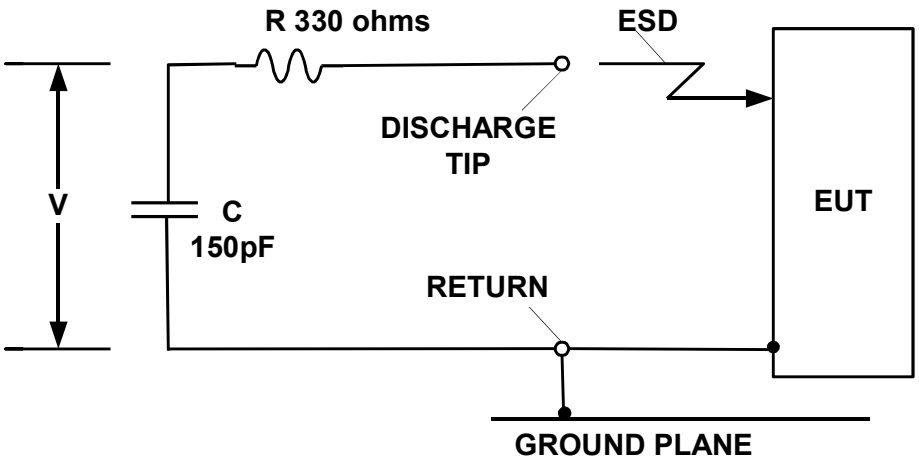


B. CONTRAST

WESTAR CORPORATION FPM-510



C. ESD ON AIR DISCHARGE MODE

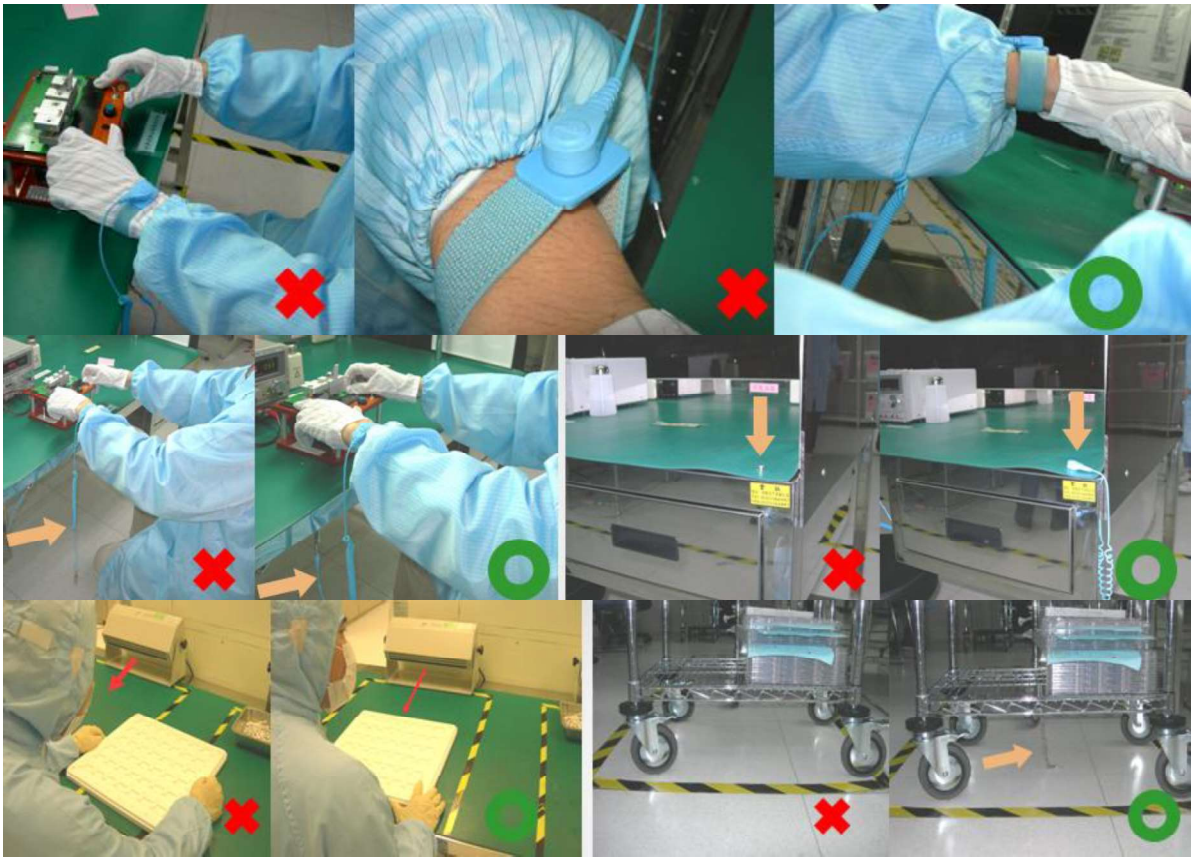


APPENDIX 3: PRECAUTIONS FOR USING THE OLED MODULE

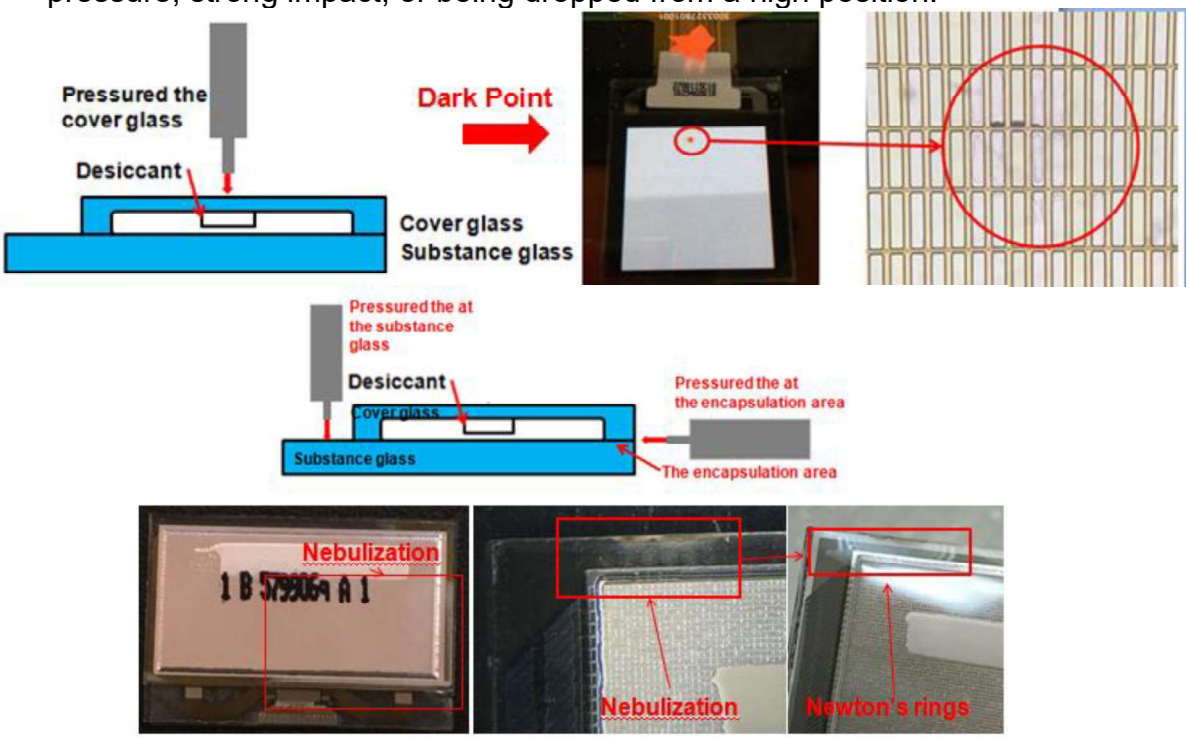
Precautions for Handling

1. When handling the module, wear powder-free anti static rubber finger cots/ anti-static clothing, anti-static gloves ,antistatic wrist strap and anti-static shoes
   The environment should dispose the static elimination blower, anti-static pad, anti-static chair, and anti-static floor. The humidity maintains usually more than 40%

2. 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. Antistatic wrist strap should touch human body directly instead of gloves. (See below photos).



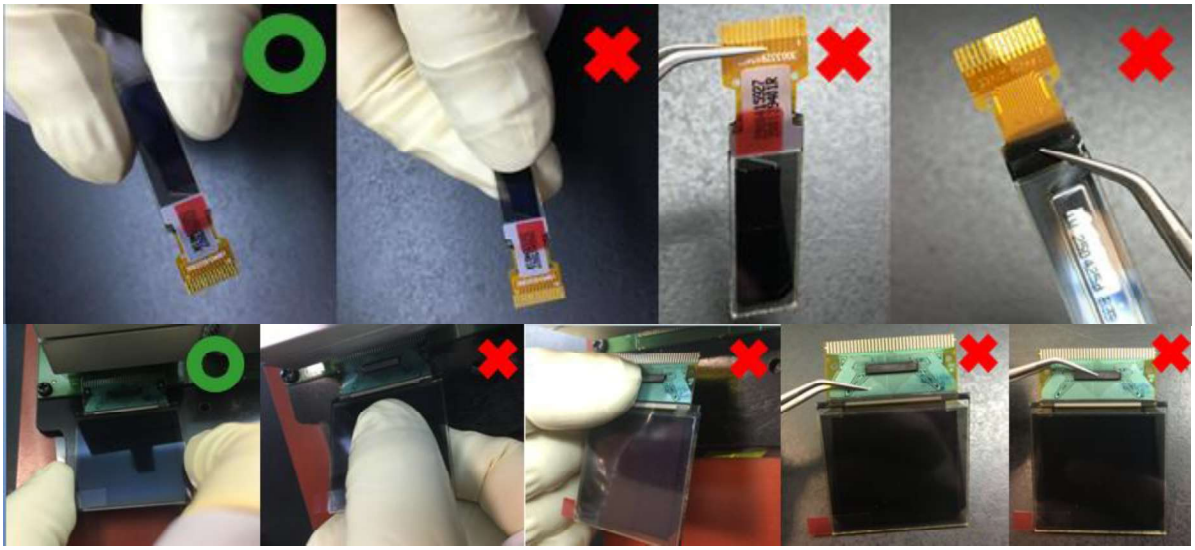
3. The OLED module is consisted of glass and film, and it should avoid pressure, strong impact, or being dropped from a high position.



4. Take out the panel one by one from the holding trays for assembly, and never put the panel on top of another one to avoid the scratch.

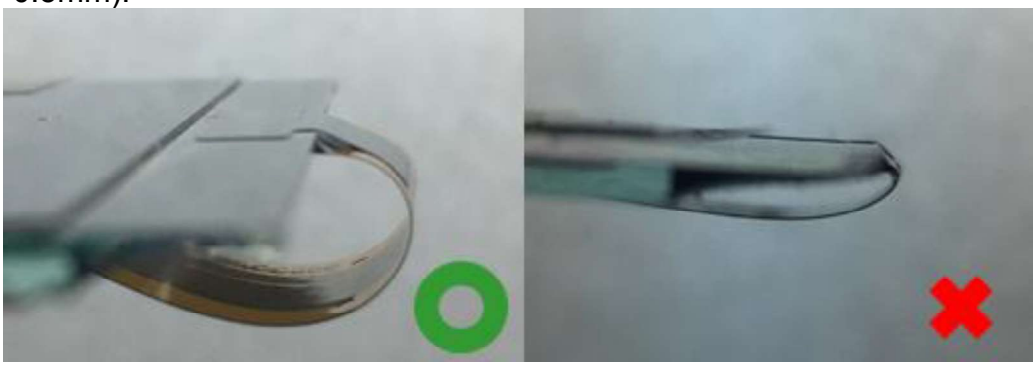
5. Avoid jerk and excessive bend on TAB/FPC/COF, and be careful not to let foreign matter or bezel damage the film.

6. When handling and assembling the module (panel + IC), grab the panel, not the TAB/FPC/COF.

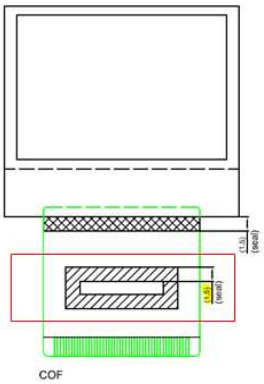


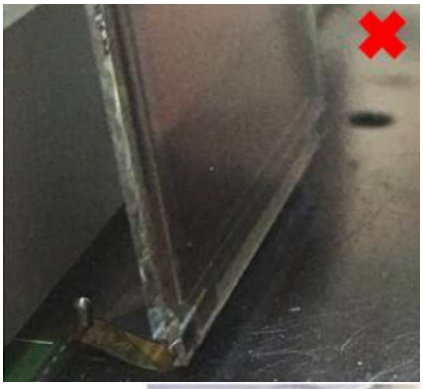
7. Use the tweezers to open the clicks on the connector of PCB before the insertion of FPC/COF, and click them back in. Once the FPC/COF sits properly in the connector, use the tweezers to avoid the damages.

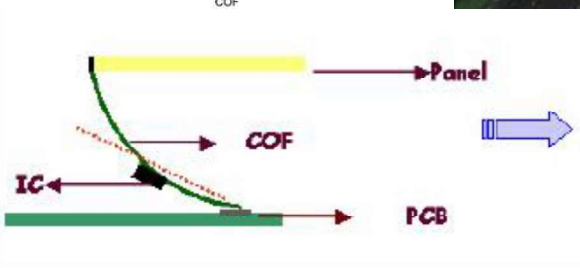
8. Please do not bend the film near the substrate glass. It could cause film peeling and TAB/FPC/COF damage. For TAB, It should bend the slit area as actual OLED it is. For FPC or COF, it is suggested to follow below pictures for instruction (distance between substrate glass and bending area >1.5mm; R>0.5mm).



9. Avoid bending the film at IC bonding area. It could damage the IC ILB bonding. It should avoid bending the IC seal area. Please keep the bending distance >1.5mm.

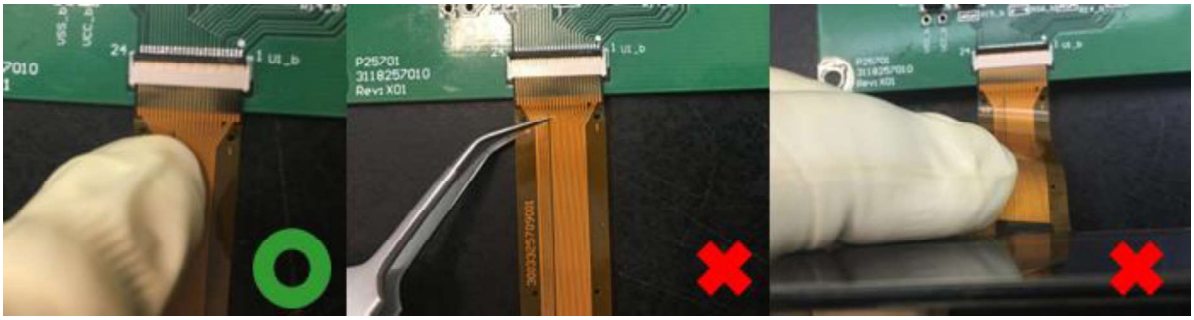






Use finger to insert COF /FPC into the connector when assembling the panel. Please refer to the photo.

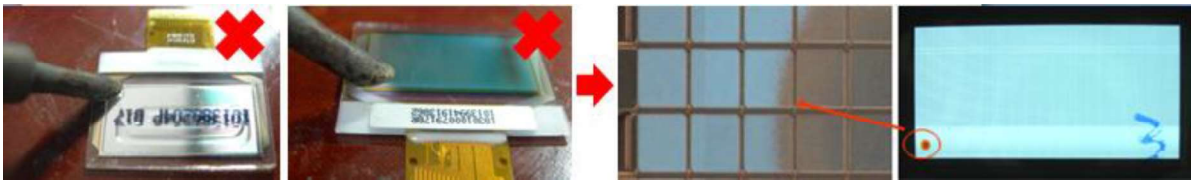
COF: Use both thumbs



10. Do not wipe the pin of film and polarizer with the dry or hard materials that will damage the surface. When cleaning the display surface, use the soft cloth with solvent, IPA or alcohol, to clean.

11. Protection film is applied to the surface of OLED panel to avoid the scratch. Please remove the protective film before assembling it. If the OLED panel has been stored for a long time, the residue adhesive material of the protective film may remain on the display surface after remove the protective film. Please use the soft cloth with solvent, IPA or alcohol, to clean.

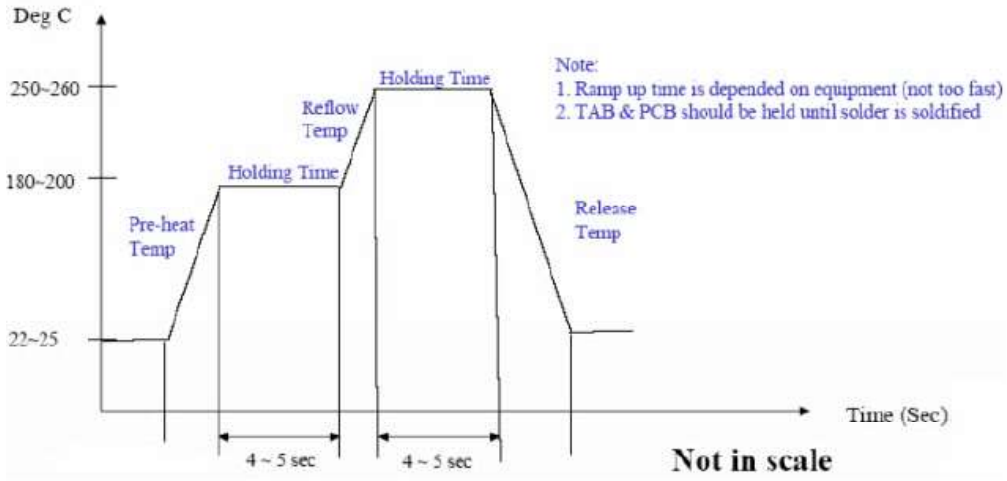
12. When hand or hot-bar soldering TAB/FPC onto PCB, make sure the temperature and timing profiles to meet the requirements of soldering specification (the specification depends on the application or optimized by customer) to prevent the damage of IC pins by inappropriate soldering, and also avoid the high temperature to damage the Organic light-emitting materials.



13. Solder residues arise from soldering process have to be cleaned up thoroughly before the module assembly.

14. Use the voltage and current settings listed in the specification to do the function test after the module assembly.

15. Suggestion for soldering process:
    i. TAB Lead- free soldering hot bar process
        1. Use pulse heated bonding tool equipment
        2. Material: Sn/Ag/Cu lead-free solder paste with typical 25um thickness on PCB pad. The TAB pin size and shape may be different, please base on the production line to adjust the thickness of PCB pad and temperature.S
        3. Bonding Force:--4kg per centimeter square as the starting point.
        4. Suggested bonding tool temperature & time profile is as below for reference. Since there are differences in TAB soldering pins, soldering technicians' skills, mechanism…etc., the soldering conditions must be adequately tuned.



    ii. TAB Lead- free soldering wire process
        In case of manual soldering (Lead- free solder wire)
        1. Solder wire contact iron directly: 280±5°C at 3-5secs
        2. Solder wire contact TAB lead directly (near iron but not contact): 380±5 °C, 3-5secs
        3. Since there are differences in TAB soldering pins, soldering technicians' skills, mechanism…etc., the soldering conditions must be adequately tuned.
    iii. High temperature will result in rapid heat conduction to IC and might cause damage to IC, so please keep the temperature below 380°C. Also, avoid damaging the polyimide and solder resist which might take place at high temperatures. Refold cycles base on the de-soldering status, if the plating of pin was damaged, it can not be used again.

Precautions for Electrical

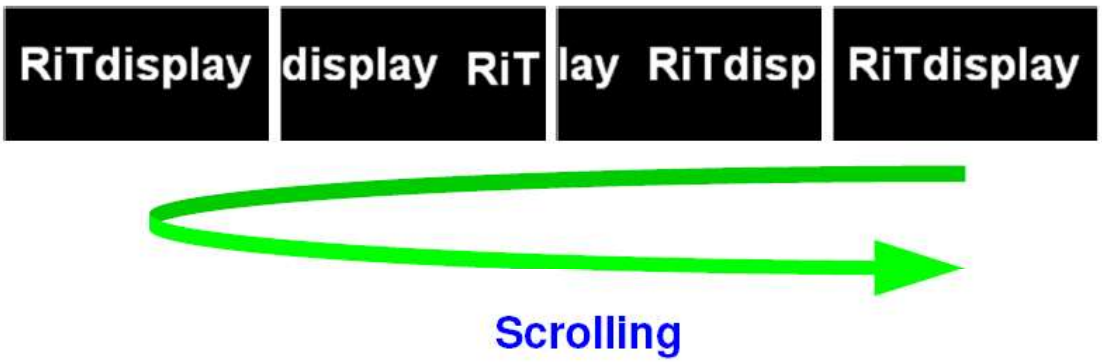
1. Residual Image (Image Sticking)

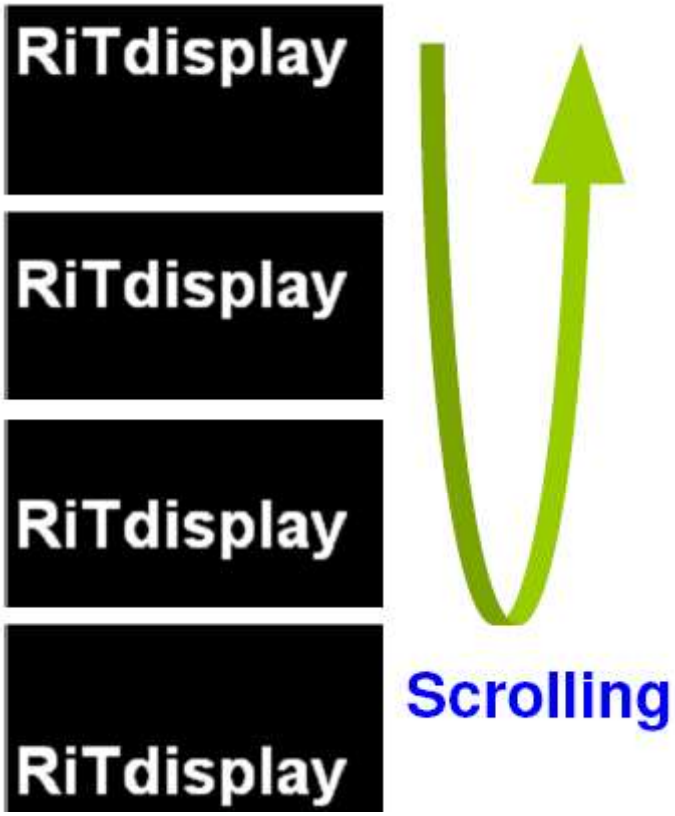
The OLED is a self-emissive device. As with other self-emissive device or displays consisting of self-emissive pixels, when a static image frozen for a long period of time is changed to another one with all-pixels-on background, residual image or image sticking is noticed by the human eye. Image sticking is due to the luminance difference or contrast between the pixels that were previously turned on and the pixels that are newly turned on. Image sticking 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 four strategies to minimize image sticking.

1. Employ image scrolling or animation to even out the lit-on time of each and every pixel on the display, also could use standby mode for reduced the residual image and extend the power capacity.
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.
3. Avoid displaying the characters or menu with high brightness level in a fix position for a long time or repeatedly. If necessary, using the auto fadeout technology.
4. If a static logo is used in the reliability test, 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.

Black Background

Scrolling example

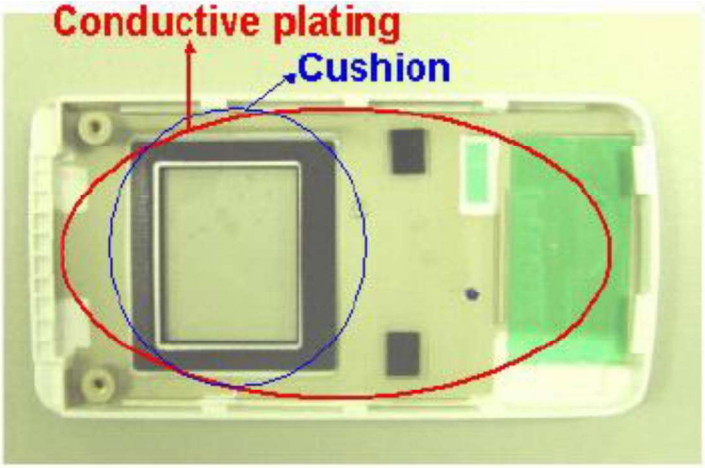




Precautions for Mechanical

1. Cushion or Buffer tape on the cover glass

It is strongly recommended to have a cushion or buffer tape to apply on the panel backside and front side when assembling OLED panel into module to protect it from damage due to excessive extraneous forces.



It is recommended that a plating conductive layer be used in the housing for EMI/EMC protection. And, the enough space should be reserved for the IC placement if the IC thickness is thicker than the TAB film when customer design the PCB.

2. Avoid excessive bending of film when handling or designing the panel into the product

The bending of TAB/COF/FPC has to follow the precautions indicated in the specification, extra bending or excessive extraneous forces should be avoided to minimize the chances of film damage. If bending the film is necessary, please bend the designated bending area only. Please refer to items 8 and 9 of Precautions for Handling for more information.

Precautions for Storage and Reliability Test

1. Storage

Store the packed cartons or packages at -5°C~+35°C, 30%~65%RH. Do not store the OLED module under direct sunlight or UV light. For best panel performance, unpack the cartons and start the production of the panels within six months after the reception of them.

2. Reliability Test

RiTdisplay only guarantees the reliability of the OLEDs under the test conditions and durations listed in the specification.