

SPECIFICATION FOR AMOLED Module

MODULE No:	ID-090WQOEN010-C000
CUSTOMER:	

I-DISPLAY	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

[illegible]

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* **Description**

This is a color active matrix AMOLED module using Low Temperature Poly-silicon Thin Film Transistors as active switching devices. This module has a 9.06 inch diagonally measured active area with 2400horizontal by 1504vertical pixel arrays. Each pixel is divided into RED and GREEN dots, or BLUE and GREEN dots, and two pixels share RED or BLUE dots which are arranged in vertical stripe and this module can display 10bit colors.

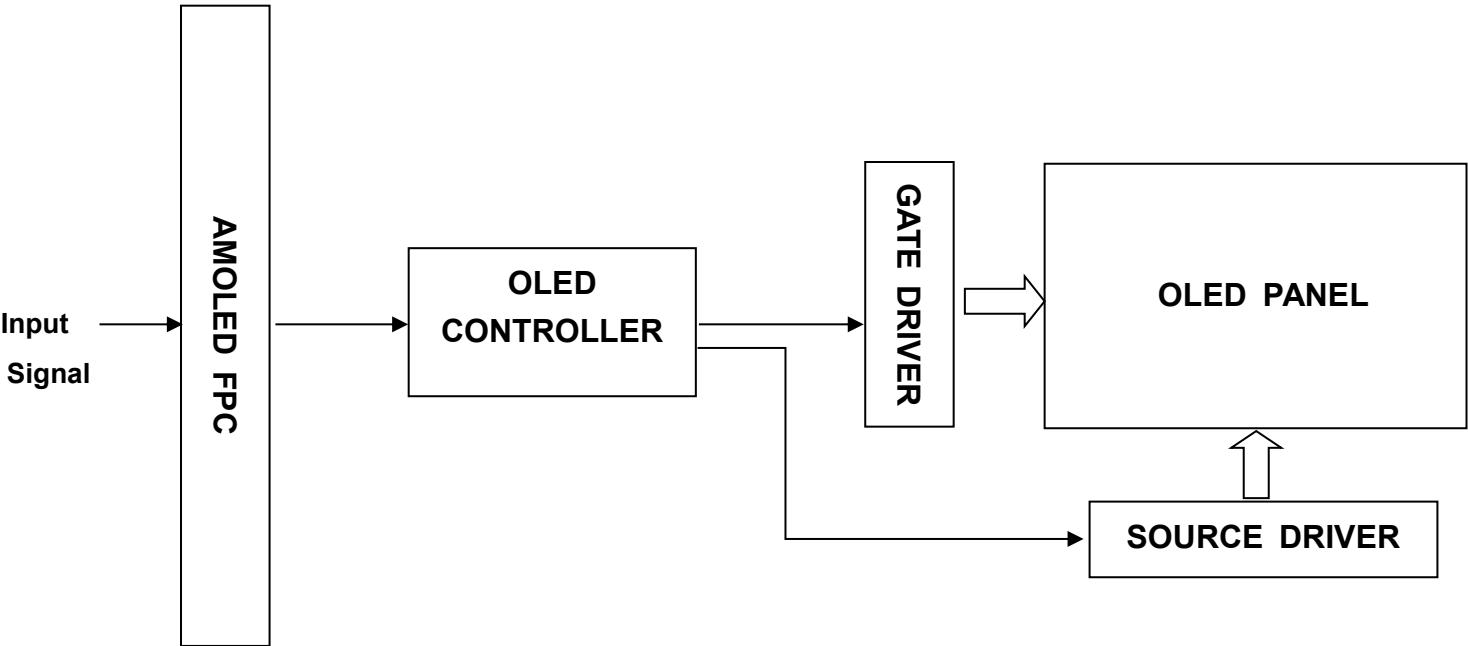
* **Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	195.048(H)*122.230V) (9.06 inch)	mm	
Driver element	LTPS TFT active matrix	-	
Display colors	RGB 10bit input	colors	
Number of pixels	2400(RGB)*1504	dots	
Pixel arrangement	Real RGB vertical stripe	-	
Pixel Per Inch	313	PPI	
Viewing angle	ALL	o'clock	
Controller IC	HX83211-A *3	-	
T-con	HX8874-A	-	
Touch technology	On-cell	-	
LCM Interface	eDP 1.4b	-	
Display mode	AMOLED	-	
Operating temperature	-10~+60	℃	
Storage temperature	-30~+70	℃	

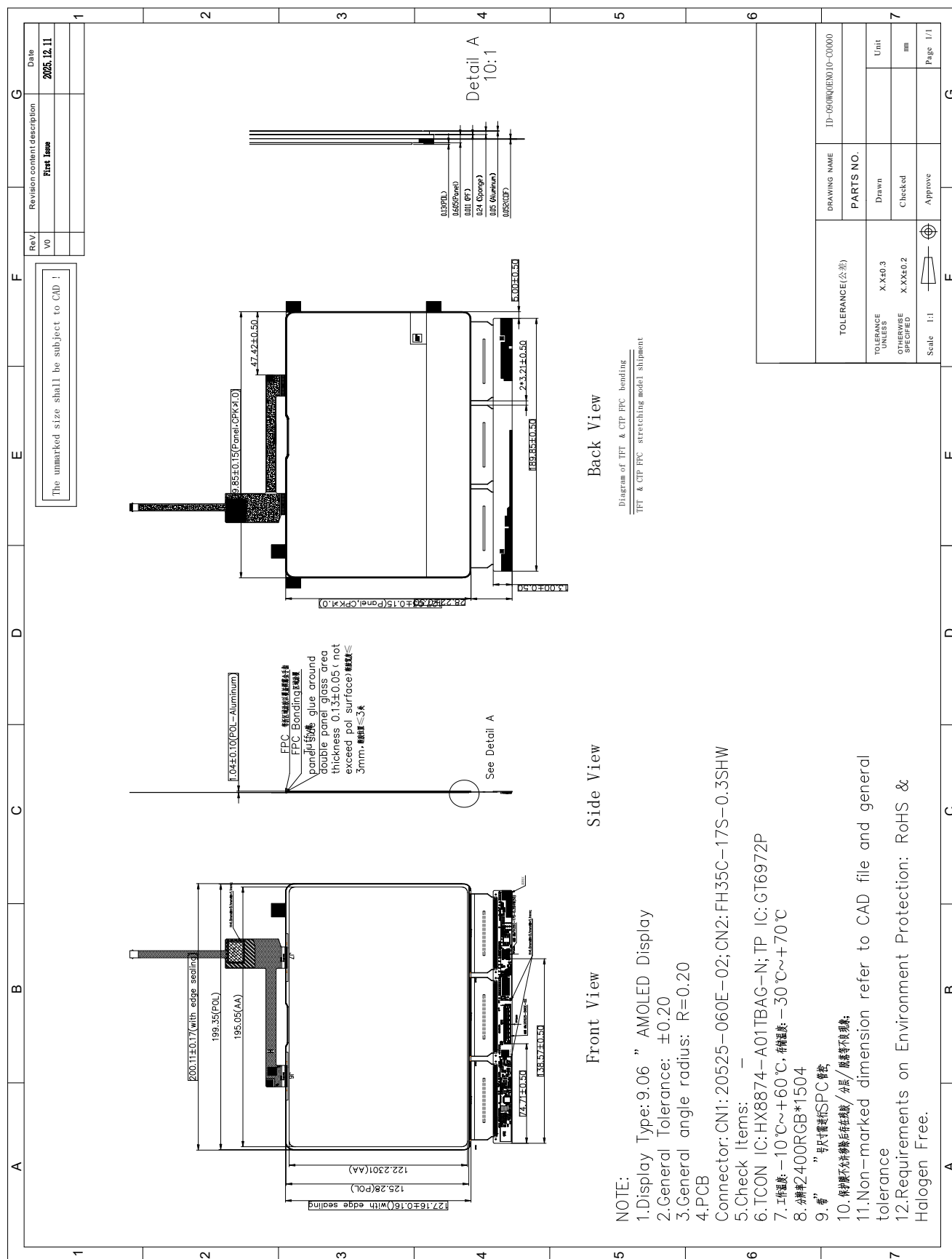
* **Mechanical Information**

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		200.11		mm	-
	Vertical(V)		127.16		mm	-
	Depth(D)		1.04		mm	-
Weight			TBD		g	-

1. Block Diagram



2. Outline dimension



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3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	ELVDD	OLED POWER	P
2	ELVDD		
3	ELVDD		
4	ELVDD		
5	ELVDD		
6	NC	NC	-
7	GND	Ground	P
8	SPI_CS_N_I	EDO	I
9	SPI_CLK_I		
10	SPI_MISO_I		
11	SPI_MOSI_I		
12	GND	Ground	I
13	SWIRE	EL PMIC 控制	O
14	I2C_M_SCL		-
15	I2C_M_SDA		-
16	Bist_EN_CN	Bist 模式使能	P
17	GND		P
18	eDP_AUXP_IN_CN	eDP 信号	I
19	eDP_AUXN_IN_CN		I
20	GND		P
21	eDP_RX0N_IN_CN		I
22	eDP_RX0P_IN_CN		I
23	GND		P
24	eDP_RX1N_IN_CN		I
25	eDP_RX1P_IN_CN		I
26	GND		P

27	eDP_RX2N_IN_CN		I
28	eDP_RX2P_IN_CN		I
29	GND		P
30	eDP_RX3N_IN_CN		I
31	eDP_RX3P_IN_CN		I
32	GND		P
33	T-CON_RDY	BL_EN	--
34	TCON_HPD_CN	HPD	P
35	TP_SPI_CLK	TP 相关信号	
36	TP_SPI_CS		
37	TP_SPI_MISO		
38	TP_SPI_MOSI		
39	I2C_S_SDA	TCON Debug	-
40	I2C_S_SDL		-
41	TP_RST	TP 相关信号	P
42	TP_REPORT_EN		P
43	TP_INT		P
44	TP_I2C_SDA		P
45	TP_I2C_SCL		P
46	NC	NC	P
47	TP_VCC	TP 电源	--
48	TP_VCC		P
49	VCC	Logic 电源	P
50	VCC		P
51	VCC		P
52	VCC		P
53	VCC		--
54	NC	NC	--

55	ELVSS	OLED 电源	P
56	ELVSS		
57	ELVSS		
58	ELVSS		
59	ELVSS		
60	GND	Ground	P

4. OLED Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	1000000				(1)(2)
Response time						1	msec	(1)(3)
LCM Luminance		LV		585	650	715	cd/m2	
Color gamut		S(%)			101		%	(1)
Color Filter Chromaticity	White	W _X		-0.04	0.303	+0.04		(1)(4)
		W _Y			0.326			
	Red	R _X			0.676			
		R _Y			0.324			
	Green	G _X			0.228			
		G _Y			0.688			
	Blue	B _X			0.138			
		B _Y			0.044			
Viewing angle	Hor.	Θ _L	CR>10	TBD	--	--	(1)(4)	
		Θ _R		TBD	--	--		
	Ver.	Θ _U		TBD	--	--		
		Θ _D		TBD	--	--		
Option View Direction		ALL						(5)

*The data comes from the OLED specification.

Measuring Condition

Measuring surrounding : dark room

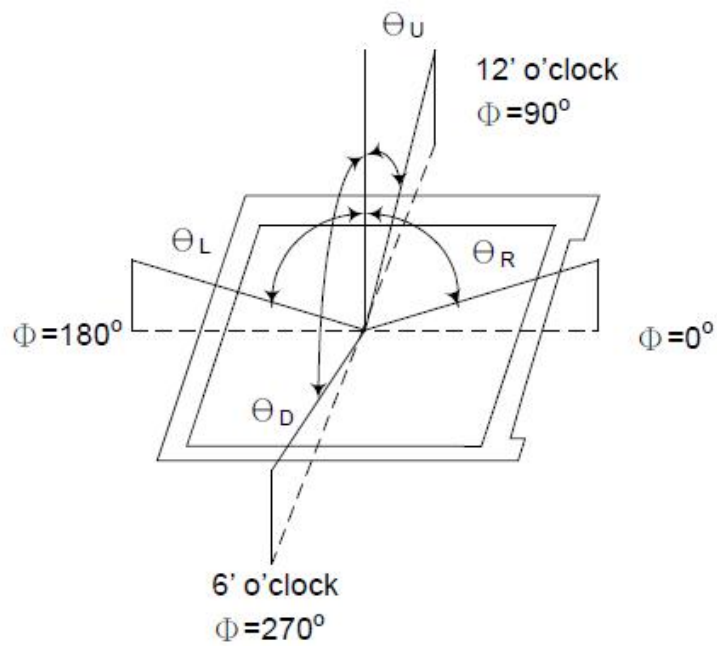
Ambient temperature : 25±2°C

15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

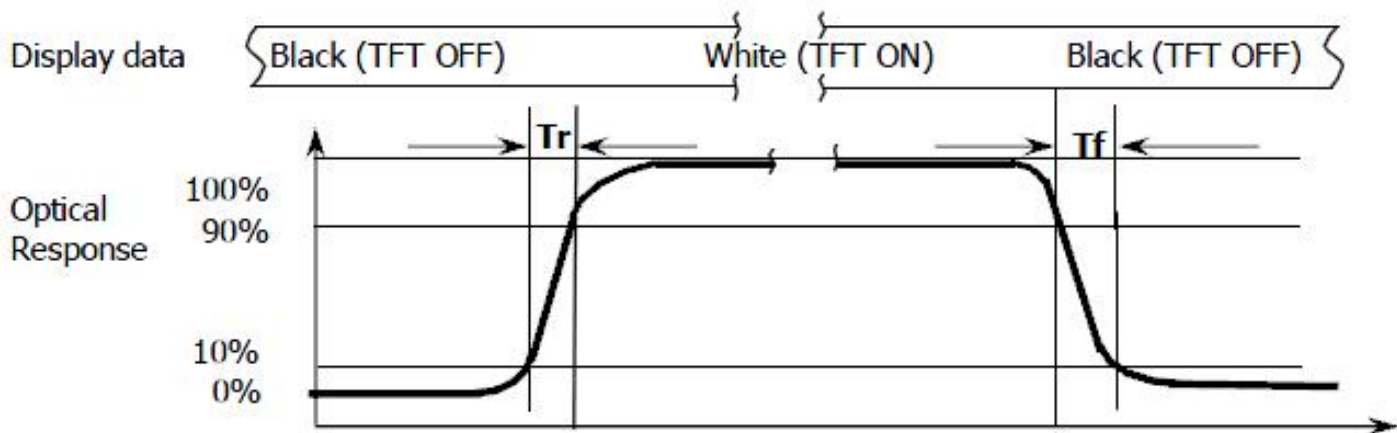
Note (1): Definition of Viewing Angle :



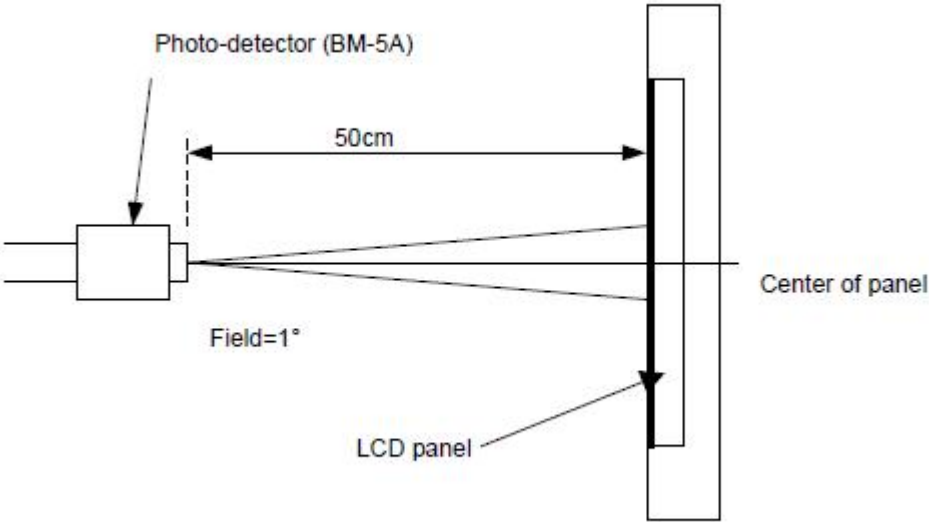
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. TFT Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

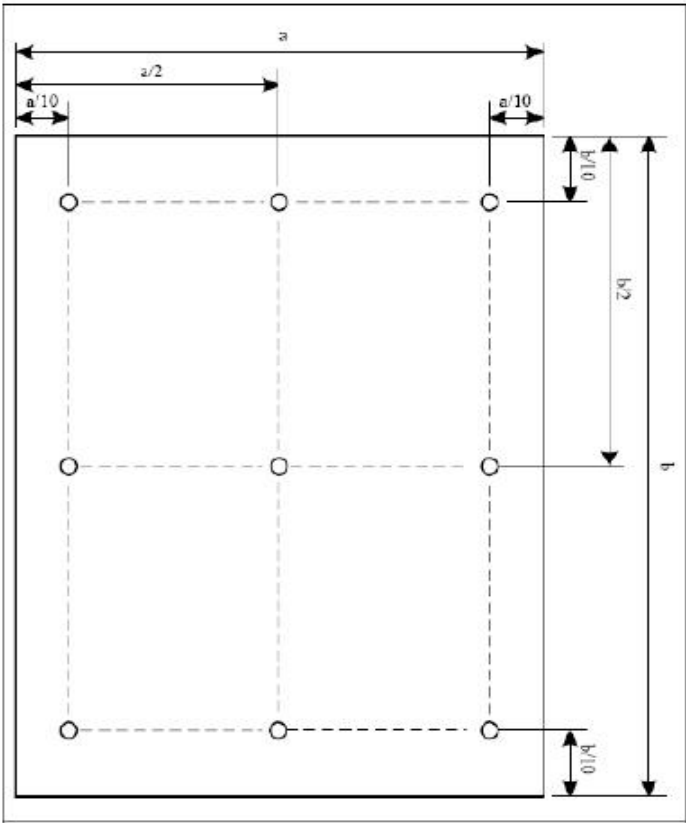
Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VCC	-0.3	3.6	V
Power supply for source driver	ELVDD	-0.3	5.0	V
Power supply for source driver	ELVSS	-3.2	0.3	V
Operating temperature	T _{OP}	-10	+60	°C
Storage temperature	T _{ST}	-30	+70	°C

NOTE: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VCC	3	3.3	3.6	V	--
TP Power supply	TP_VCC	3	3.3	3.6	V	--
Power supply for source driver	ELVDD	4.8	4.9	5.0	V	--
Power supply for source driver	ELVSS	-2	-2.4	-3.2	V	--
Normal mode Current consumption	IDD	--	550	605	mA	--
Frame Frequency	fFRAME	60/120/144/166Hz±1Hz			HZ	--

NOTE 3: Luminance Uniformity of these 9 points is defined as below:

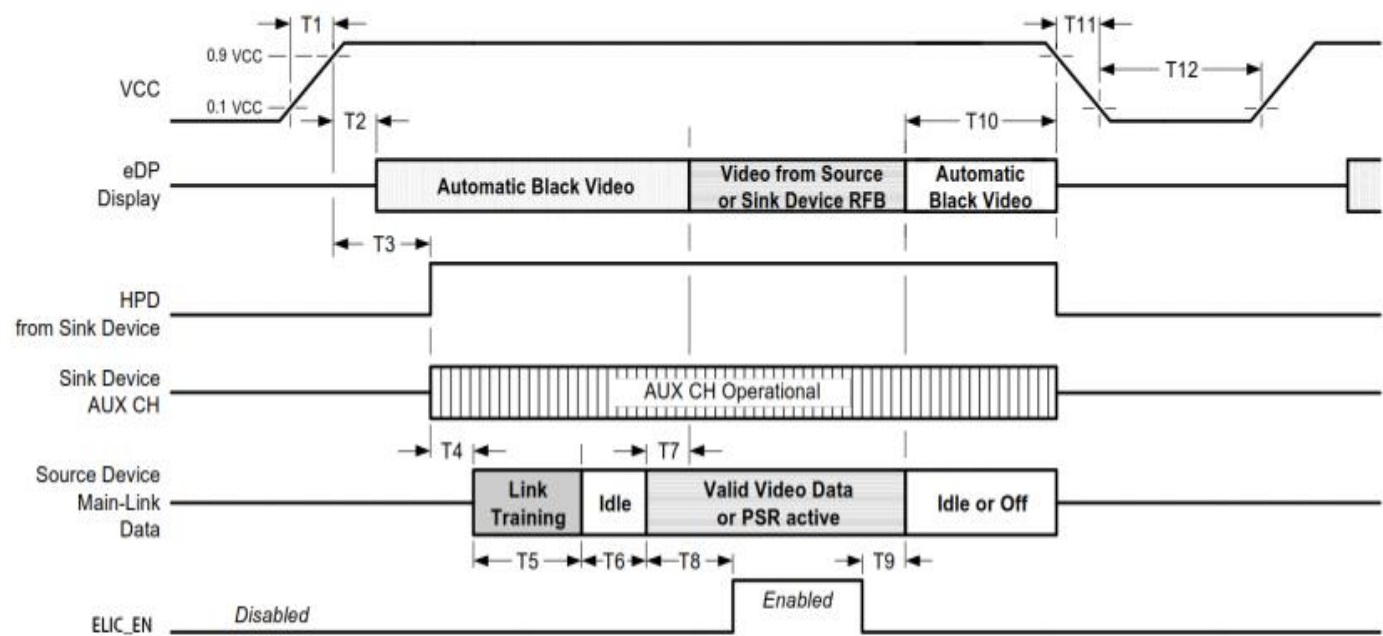


$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

6. Recommended Operating Sequence

Note1) Power on/off Timing



Parameter	Description	Reqd. By	Value		Unit	Ref.
			Min	Max		
t1	Power rail rise time, 10% to 90%	Source	0.5	10	ms	-
t2	Delay from OLED,V _{CCS} to	Sink	0	80	ms	Automatic Black Video

	black video generation					generation prevents display noise until valid video data is received from the Source (see Remark: 2 and 3 below)
t3	Delay from OLED, Vccs to HPD high	Sink	0	80	ms	Sink AUX Channel must be operational upon HPD high (see Remark: 4 below)
t4	Delay from HPD high to link training initialization	Source	0	-	ms	Allows for Source to read Link capability and initialize
t5	Link training duration	Source	0	-	ms	Dependant on Source link training protocol
t6	Link idle	Source	0	-	ms	Min Accounts for required BS-Idle pattern. Max allows for Source frame synchronization
t7	Delay from valid video data from Source to video on display	Sink	0	50	ms	Max value allows for Sink to validate video data and timing. At the end of T7, Sink will indicate the detection of valid video data by setting the SINK_STATUS bit to logic 1 (DPCD 00205h, bit 0), and Sink will no longer generate automatic Black Video
t8	Delay from valid video data from Source to backlight on	Source	80	-	ms	Source must assure display video is stable
t9	Delay from backlight off to end of valid video data	Source	50	-	ms	Source must assure backlight is no longer illuminated. At the end of T9, Sink will indicate the detection of no valid video data by setting the SINK_STATUS bit to logic 0 (DPCD 00205h, bit 0), and Sink will automatically display Black Video. (See Remark: 2 and 3 below)
t10	Delay from end of valid video data from Source to power off	Source	0	500	ms	Black video will be displayed after receiving idle or off signals from Source

t11	V _{CCS} power rail fall time, 90% to 10%	Source	0.5	10	ms	-
t12	V _{CCS} Power off time	Source	500	-	ms	-

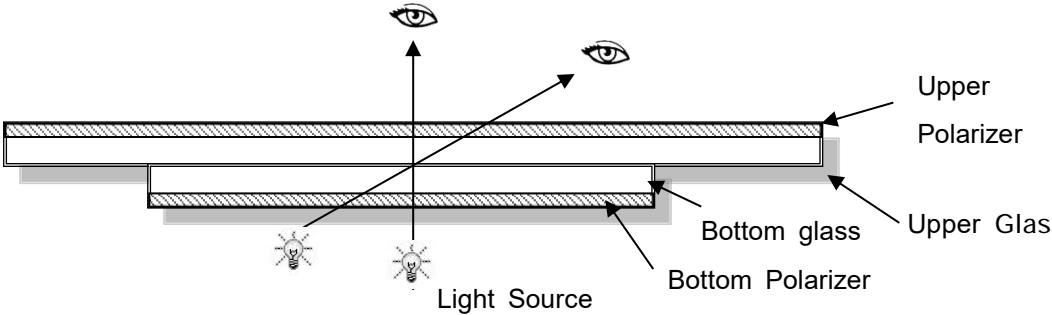
7. OLED Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

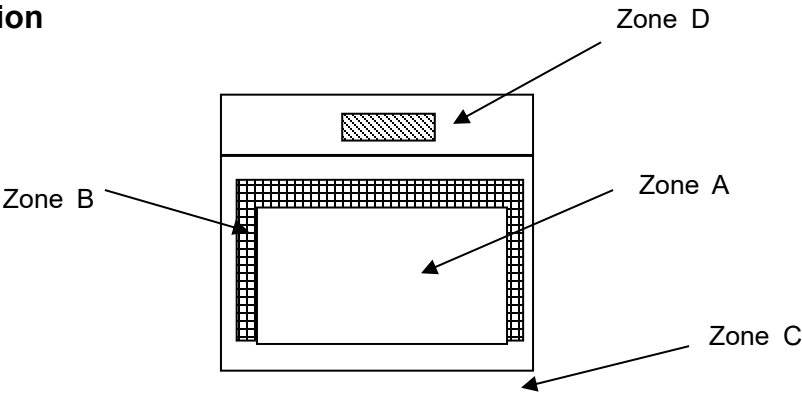
7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

- Temperature : 25±5°C
- Humidity : 65%±10%RH
- Viewing Angle : Normal viewing Angle.
- Illumination: Single fluorescent lamp (300 to 700Lux)
- Viewing distance:30-50cm



7.1.2 Definition



- Zone A : Effective Viewing Area(Character or Digit can be seen)
- Zone B : Viewing Area except Zone A
- Zone C Cover (Zone A+Zone B) which can not be seen after assembly by customer .)
- Zone D : IC Bonding Area

Note:
As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer

7.1.3 Sampling Plan

According to GB/T 2828-2012 ; , normal inspection, Class II

AQL:

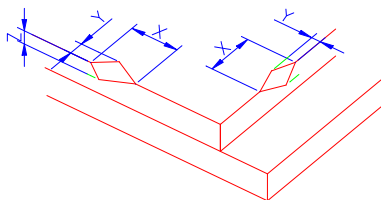
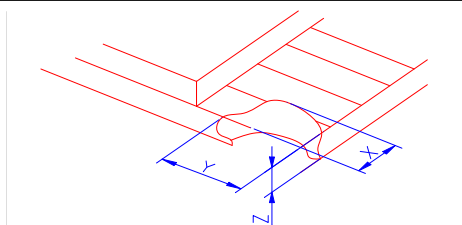
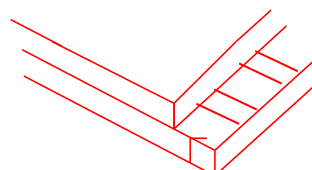
Major defect	Minor defect
0.65	1.5

OLED: Liquid Crystal Display , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc	Major
2	Missing	Missing components and etc	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed, deformation and etc	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot, Dim spot, (Note1) Polarizer Air Bubble, Polarizer accidented spot and etc	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc	
7	OLED/Polarizer	Black/White spot/line, scratch, crack, etc.	

Note1: a) Light dot: Dots appear bright and unchanged in size in which OLED panel is displaying under black pattern.
b) Dim dot: Dots appear dark and unchanged in size in which OLED panel is displaying under pure red, green, blue picture.

7.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 OLED Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of IT O, T: Height of OLE D	(1) The edge of OLE D broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2)OLED corner broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) OLED crack	 Crack Not allowed							

Spot defect

2.0

Φ=(X+Y)/2

① light dot (black/white spot , pinhole, stain, etc.)

Zone Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance ≥ 10mm)		
0.25<Φ≤0.4	2(distance ≥ 10mm)		
Φ>0.4	0		

② Dim spot (light leakage、dent、dark spot, etc)

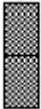
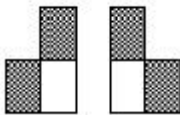
Zone Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance ≥ 10mm)		
0.25<Φ≤0.4	2(distance ≥ 10mm)		
Φ>0.4	0		

③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.5	2(distance ≥ 10mm)		
Φ>0.5	0		

④Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.4	2(distance ≥ 10mm)		
Φ>0.4	0		

3.0	OLED Pixel defect	Pixel bad points <table border="1"> <thead> <tr> <th>Item</th><th>Zone A</th><th>Acceptable Qt</th></tr> </thead> <tbody> <tr> <td rowspan="3">Bright dot</td><td>Random</td><td>$N \leq 2$</td></tr> <tr> <td>2 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>3 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td rowspan="3">Dark dot</td><td>Random</td><td>$N \leq 3$</td></tr> <tr> <td>2 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>3 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>Distance</td><td> 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. </td><td>5mm</td></tr> <tr> <td colspan="2">Total bright and dark dot</td><td>$N \leq 4$</td></tr> </tbody> </table> Note: A) Bright dot: Dots appear bright and unchanged in size in which OLED panel is displaying under black pattern. B) Dark dot: Dots appear dark and unchanged in size in which OLED panel is displaying under pure red, green, blue picture. C) 2 dot adjacent = 1 pair = 2 dots Picture:  2 dot adjacent  2 dot adjacent (vertical)  2 dot adjacent  2 dot adjacent (slant)	Item	Zone A	Acceptable Qt	Bright dot	Random	$N \leq 2$	2 dots adjacent	$N \leq 0$	3 dots adjacent	$N \leq 0$	Dark dot	Random	$N \leq 3$	2 dots adjacent	$N \leq 0$	3 dots adjacent	$N \leq 0$	Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm	Total bright and dark dot		$N \leq 4$
Item	Zone A	Acceptable Qt																							
Bright dot	Random	$N \leq 2$																							
	2 dots adjacent	$N \leq 0$																							
	3 dots adjacent	$N \leq 0$																							
Dark dot	Random	$N \leq 3$																							
	2 dots adjacent	$N \leq 0$																							
	3 dots adjacent	$N \leq 0$																							
Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm																							
Total bright and dark dot		$N \leq 4$																							

4.0	Line defect (OLED /Polarizer backlight black/white line, scratch, stain)  W: width, L : length N : Count	Width(mm)	Length(m)	Acceptable Qty		
				A	B	C
		$\Phi \leq 0.05$	Ignore	Ignore		Ignore
		$0.05 < W \leq 0.06$	$L \leq 5.0$	$N \leq 3$		
		$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$		
$W > 0.08$	Define as spot defect					
5.0	Electronic Components SMT.	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite				
6.0	Display color& Brightness.	1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.				
7.0	OLED Mura/Waving/Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.				

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	CTP no function	Not allowed

8. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	60°C,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the OLED; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-10°C, 96HR	
High Temperature Storage	70°C, 96HR	
Low Temperature Storage	-30°C, 96HR	
High Temperature & High Humidity Storage	+60°C, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-30°C,30 min ↔ 70°C,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80cm(MEDIUM BOX)	

- Remark:
- 1.The test samples should be applied to only one test item.
 - 2.Sample size for each test item is 5~10pcs.
 - 3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
 - 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
 - 5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
 - 6. The color fading mura of polarizing filter should not care.

9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

- (1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
- (2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
- (4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
- (5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static; it may cause damage to the CMOS ICs.
- (9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (10) Do not disassemble the module.
- (11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (12) Pins of I/F connector shall not be touched directly with bare hands.
- (13) Do not connect, disconnect the module in the “Power ON” condition.
- (14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

9.2 Storage and Transportation.

- (1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%
- (2) Do not store the TFT-OLED module in direct sunlight.
- (3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
- (4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
- (5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

10. Packing

----TBD-----