

SPECIFICATION FOR AMOLED+CTP Module

MODULE No:	ID-270UDOEN003-C002B
CUSTOMER:	

I-DISPLAY	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

[illegible]

Part. No	ID-270UDOEN003-C002B	REV	V1.1	Page 2 of 32
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Contents

1. Outline dimension	6
2. Outline dimension	7
3. Input terminal Pin Assignment	8
3.1 OLED PIN Define	8
3.2 CTP PIN Define	10
4. Optical Characteristics	11
4.1 Optical specification	11
5. AMOLED Electrical Characteristics	17
5.1 Absolute Maximum Rating (Ta=25 VSS=0V)	17
5.2 DC Electrical Characteristics	17
6. AC Characteristic	18
6.1 Recommended Operating Sequence	18
6.2 EDP interface Timing Characteristics	20
7. CTP Specification	21
7.1 Electrical Characteristics	21
7.1.1 Absolute Maximum Rating	21
7.1.2 DC Electrical Characteristics (Ta=25°C)	21
7.2 I2C AC Characteristics	23
8. AMOLED Module Out-Going Quality Level	24
8.1 VISUAL & FUNCTION INSPECTION STANDARD	24
8.1.1 Inspection conditions	24
8.1.2 DefinitionZone D	24
8.1.3 Sampling Plan	25
8.1.4 Criteria (Visual)	26
9. Reliability Test Result	30
10. Cautions and Handling Precautions	31
10.1 Handling and Operating the Module	31
10.2 Storage and Transportation	31
11. Packing	32

*** 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 27 inch diagonally measured active area with 3840horizontal by 2160 vertical 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 10 bit/8bit colors.

*** Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	597.6576(H)*336.1824(V) (27.0 inch)	mm	
Driver element	LTPS TFT active matrix	-	
Display colors	RGB 8/10bit	colors	
Number of pixels	3840(RGB)*2160	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.15564(H)*0.15564(V)	mm	
Viewing angle	ALL	o'clock	
Controller IC	/	-	
LCM Interface	EDP 1.4b	-	
Delivery type	FOB	-	
Operating temperature	-20~+70	℃	
Storage temperature	-40~+85	℃	
Module bonding technology	Use OCA bonding between LCM and CTP	-	

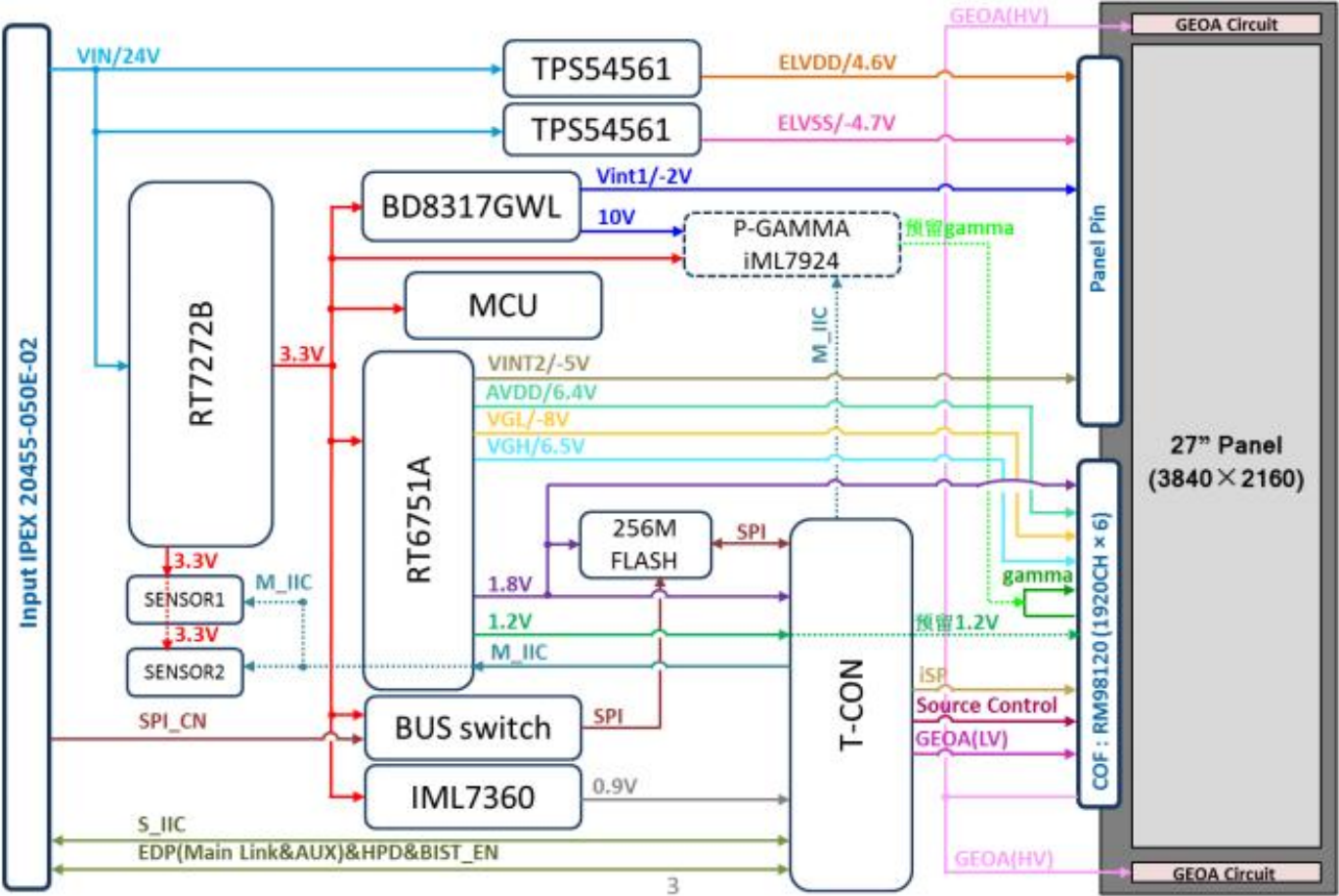
***CTP Features**

General Information Items	Specification	Unit	Note
	Main Panel		
Resolution	3840(RGB)*2160		
Structure	G+G	-	
Controller IC	ILI2510	-	
Power supply	5V		
Interface	USB & IIC	-	
Touch mode	Multiple touch	-	-

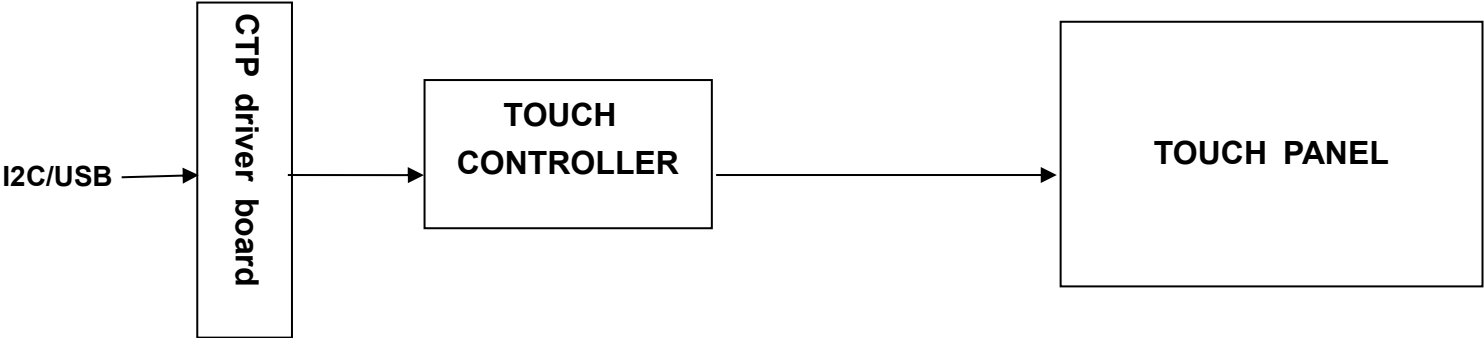
* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	--	613.0	--	mm	-
	Vertical(V)	--	361.5	--	mm	-
	Depth(D)	--	4.19	--	mm	-
Weight			TBD		--	-

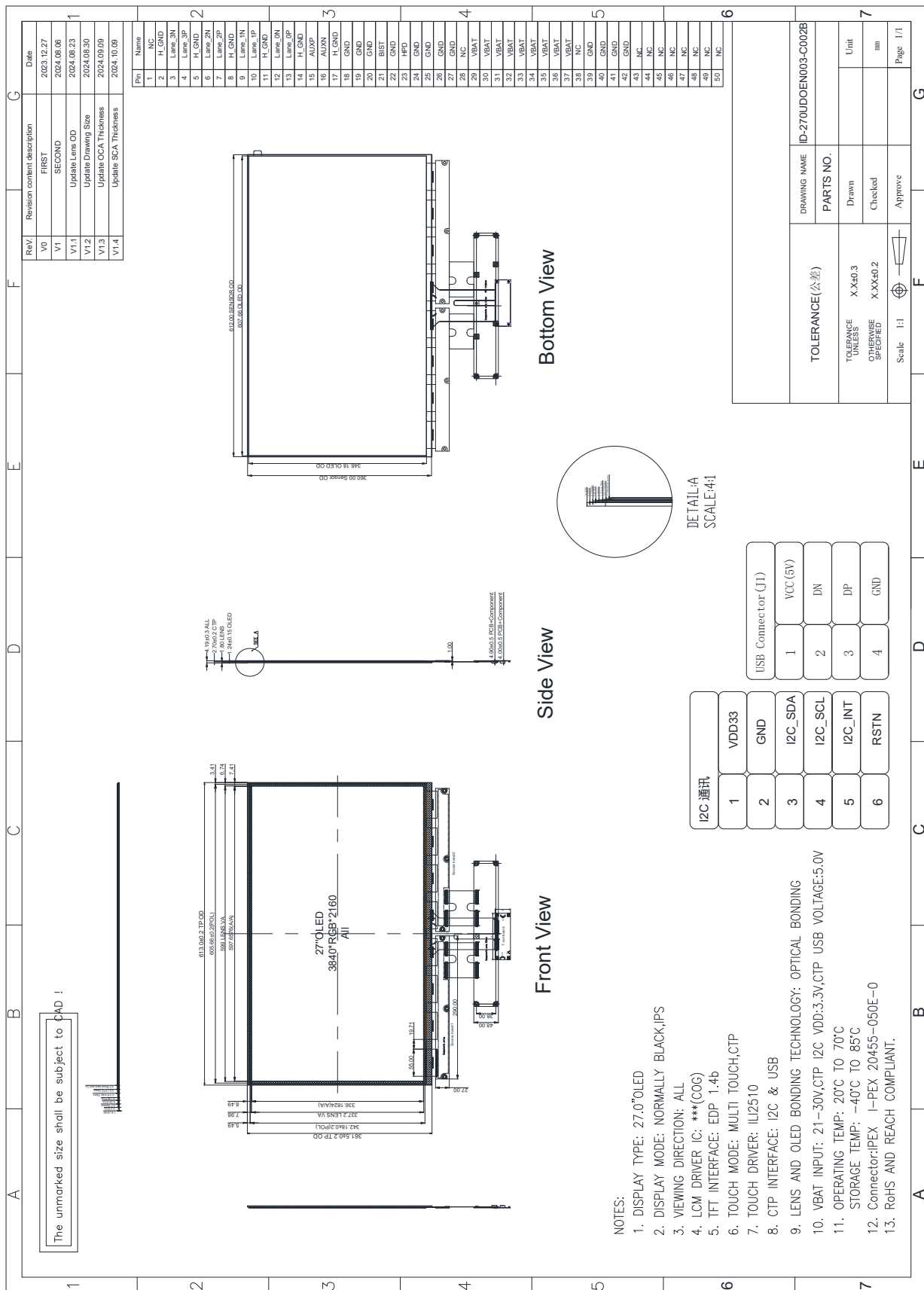
1.Outline dimension



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2. Outline dimension



Part. No	ID-270UDOEN003-C002B	REV	V1.1	Page 7 of 32
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3. Input terminal Pin Assignment

3.1 OLED PIN Define

CNT: I-PEX 20455-050E-0 (50pins, 0.5pitch) or compatible

NO.	SYMBOL	DISCRIPTION	I/O
1	NC		I
2	H_GND	Hight Speed Ground	P
3	LANE3N	Complement Signal Link Lane 3	I
4	LANE3P	True Signal Link Lane 3	I
5	GND	Hight Speed Ground	P
6	LANE2N	Complement Signal Link Lane 2	I
7	LANE2P	True Signal Link Lane 2	I
8	GND	Hight Speed Ground	P
9	LANE1N	Complement Signal Link Lane 1	I
10	LANE1P	True Signal Link Lane 1	I
11	GND	Hight Speed Ground	P
12	LANE0N	Complement Signal Link Lane 0	I
13	LANE0P	True Signal Link Lane 0	I
14	GND	Hight Speed Ground	P
15	AUXP	True Signal Auxiliary Channel	I
16	AUXN	Complement Signal Auxiliary Channel	I
17	H_GND	Hight Speed Ground	P
18	GND	Ground	P
19	GND	Ground	P
20	GND	Ground	P
21	BIST	BIST enable signal	P
22	GDN	Ground	P
23	HPD	HPD signal	P
24	GND	Ground	P

25	GND	Ground	P
26	GND	Ground	P
27	GND	Ground	P
28	VBAT	Power supply	P
29	VBAT	Power supply	P
30	VBAT	Power supply	P
31	VBAT	Power supply	P
32	VBAT	Power supply	P
33	VBAT	Power supply	P
34	VBAT	Power supply	P
35	VBAT	Power supply	P
36	VBAT	Power supply	P
37	VBAT	Power supply	P
38	NC	--	
39	GND	Ground	P
40	GND	Ground	P
41	GND	Ground	P
42	GND	Ground	P
43	NC	--	--
44	NC	--	
45	NC	--	
46	NC	--	
47	NC	--	
48	NC	--	
49	NC	--	
50	NC	--	

3.2 CTP PIN Define

I2C PIN

NO.	SYMBOL	DISCRIPTION	I/O
1	VDD	Supply voltage	P
2	GND	Ground	P
3	SDA	I2C data input and output	I
4	SCL	I2C clock input	I
5	INT	External interrupt to the host	I
6	RST	External Reset, Low is active	I

USB PIN

NO.	SYMBOL	DISCRIPTION	I/O
1	VCC(5V)	Supply voltage	P
2	USB_DN	USB- signal.	I/O
3	USB_DP	USB+ signal.	I/O
4	GND	Ground	P

4. Optical Characteristics

4.1 Optical specification

Test condition: 25°C±3°C, 65±20%RH, Dark room

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Brightness			Normal (White mode)	352	400	448	cd/m ²	(1)
Peak Luminance(10% Box)			VESA HDR	500	-	-	cd/m ²	VESA HDR 500TB
Brightness Uniformity			Full white	75%	85%	-		(2)
Contrast Ratio			by CA310	-	100,000	-	-	(3)
			by CS2000A		1,000,000			
Color of CIE Coordinate	White	x	Normal Θ=Φ=0°	0.293	0.313	0.333	-	
		y		0.309	0.329	0.349	-	
	Red	x		0.663	0.683	0.703	-	
		y		0.295	0.315	0.335	-	
	Green	x		0.19	0.22	0.25	-	
		y		0.70	0.73	0.76	-	
	Blue	x		0.117	0.137	0.157	-	
		y		0.023	0.043	0.063	-	
Color Gamut			Adobe RGB	98	100	-	%	(4)
			DCI-P3	98	100	-	%	
			sRGB	100	-	-	%	
White Temperature°K			Normal Θ=Φ=0°	6000	6500	7000	K	
Gamma			Normal Θ=Φ=0°	2.0	2.2	2.4	-	(5)
Response time			On/Off	-	1	2	ms	(6)
Viewing Angle			Top/Bottom/Right/ Left CR>10	85	-	-	°	(7)
Color Shift		Δuv	Θ=Φ=45°	-	-	0.020	-	(8)
Image Sticking		ΔL	Macbeth pattern, Max Lum, 3000h, Ambient : ~25℃, Panel : ~45℃	-	-	3.5	%	
Flicker			Normal Θ=Φ=0°	-	-	-35	dB	Pattern: W255W128W32
Crosstalk			Normal Θ=Φ=0°	-	-	1.5	%	(9)

TUV blue ray certification	415-455nm/400-500nm			50	%	(10)
OLED Life Time	T50 @ 25℃	25,000	-	-	Hrs	(11)

Note 1: Brightness follows MicroSoft brightness3 (Based on OPR 50%).

The Brightness of full white pattern (OPR100%) is the same as that of OPR 50%.



Note 2: Brightness uniformity

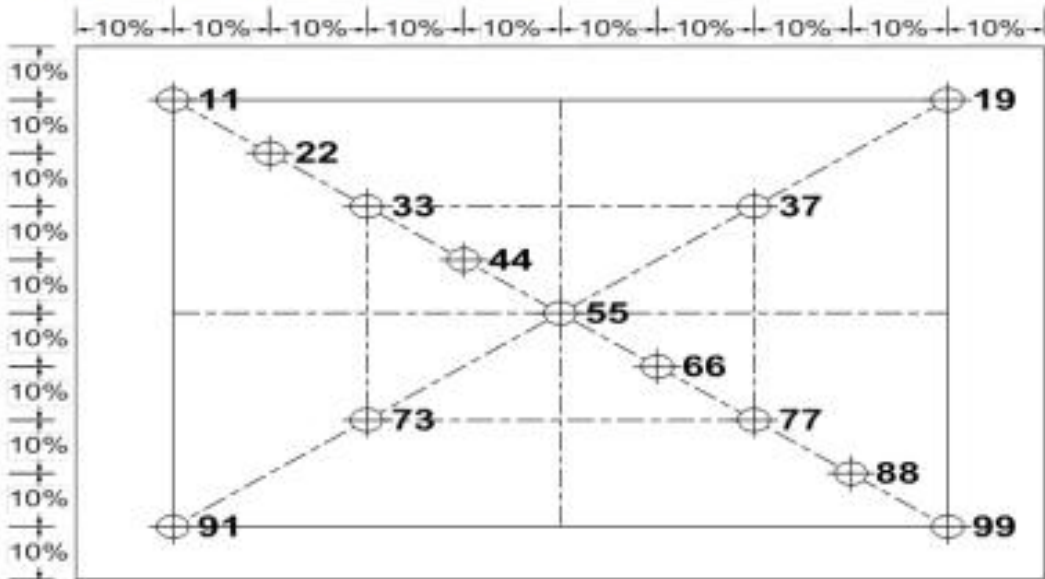
For brightness uniformity measure, EDO's request as below:

1. The test condition is at 25℃ and measured on the surface of Display panel module.
2. Measurement equipment: CA310 or similar equipment.
3. The brightness uniformity is calculated by using following formula:

Brightness Uniformity = $B_p \text{ (Min.)} / B_p \text{ (Max.)}$

$B_p \text{ (Max.)}$ = Maximum brightness in 13 measured spots

$B_p \text{ (Min.)}$ = Minimum brightness in 13 measured spots.



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Note 3: Contrast Ratio

Dark Room C.R.=LW/LB

LW: full white brightness of display center P0;

LB: full black brightness of display center P0.

Note 4: Color Gamut

For brightness uniformity measure, EDO's request as below:

- 1. Measurement equipment: CS2000A or similar equipment.
- 2. DCI-P3 & Adobe color data:

CIE1976	R	G	B
DCI-P3	(0.496,0.526)	(0.099,0.578)	(0.175,0.158)
Adobe	(0.451,0.523)	(0.076,0.576)	(0.175,0.158)
sRGB	(0.451,0.523)	(0.125,0.563)	(0.175,0.158)

- 3. The color gamut is calculated by using following formula:

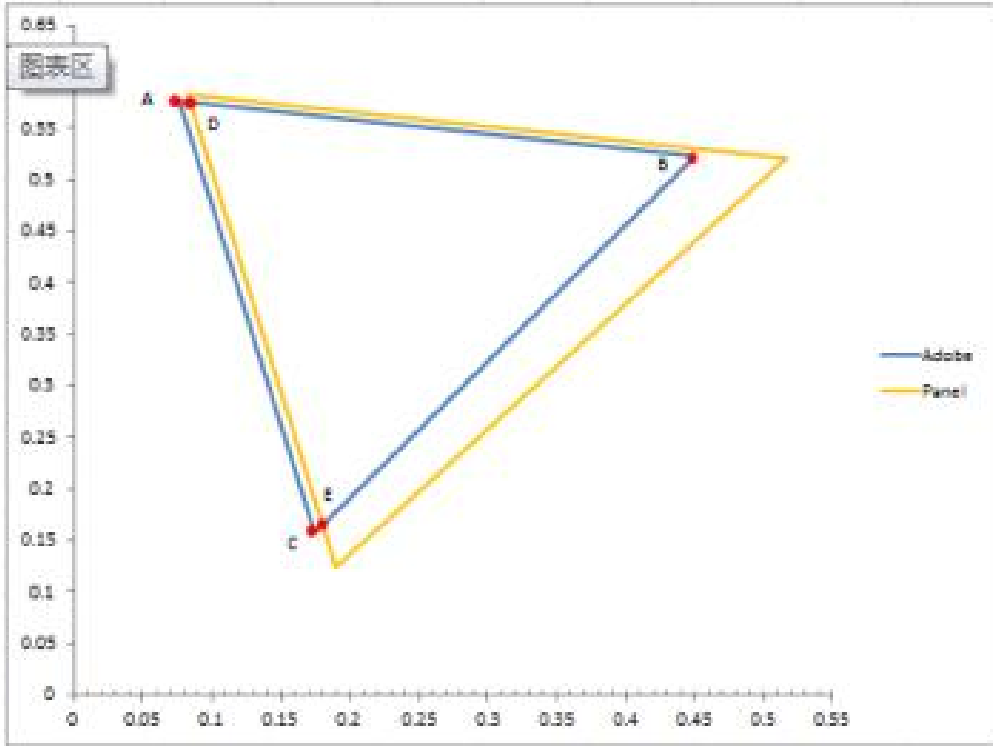
Color Gamut % = $S_{coverage} / S_{original\ color\ gamut}$

$S_{coverage}$: The area covered by panel color gamut

$S_{original\ color\ gamut}$: The triangle area of Adobe or DCI-P3 color gamut

For example:

Color Gamut % = S_{DEB} / S_{ABC} %



Note 5: Gamma

For gamma curve control, EDO's request as below:

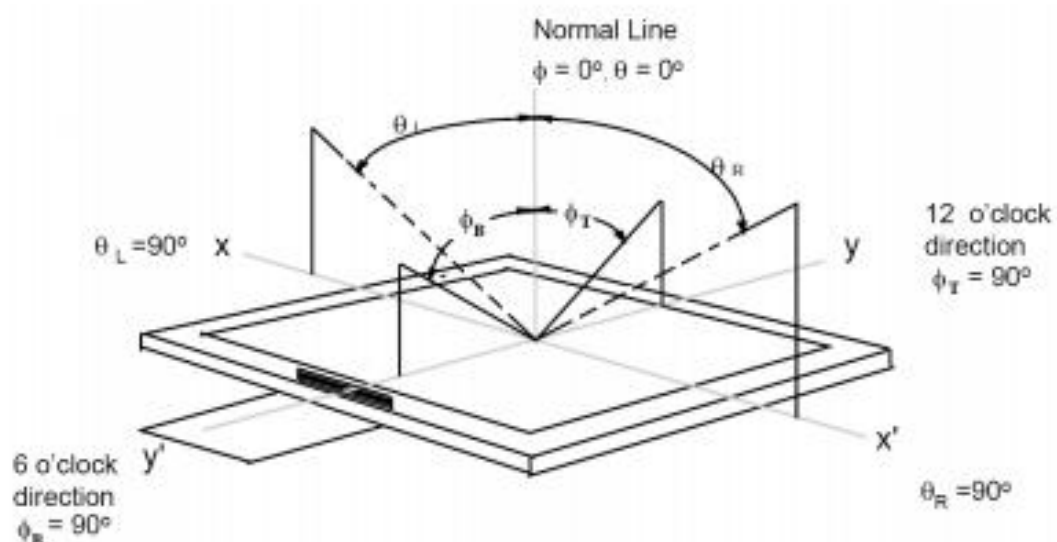
1. Calibration the test instrument. Set the screen size parameters, and measure the center point.
2. EDO will test the gray scale below, if possible also can use the patterns of gray 0 to 255 to test for example:
0, 8, 16, 25, 33, 41, 49, 58, 66, 74, 82, 90, 99, 107, 115, 123, 132, 140, 148, 156, 165, 173, 181, 189, 197, 206, 214, 222, 230, 239, 247, 255 Or
0, 1, 2, 3, ..., 252, 253, 254, 255. Total 256pcs patterns.
3. Output the measure data. Data number normalization and draw the chart.
4. The whole screen should be complied with the gamma curve of gamma 2.0 or 2.4, it means ± 0.2 error is allowed. But if there are special requirements for the special project, its required specifications can be used as a standard value, please refer the project spec.

Note 6: Response Time

Response time=Pixel turn on and turn off time (White $\leftrightarrow$ Black).
It is measuring transition time from 10% to 90% of luminance.

Note 7: The definition of Viewing Angle

Refer to the graph below marked by θ and ϕ



Note8: Color Shift

For color shift measure:

Fix on white pattern,

On the condition $\theta=0^\circ$ $F=0^\circ$, we can get the color coordinate (u_1', v_1') and on $\theta=45^\circ$ $F=45^\circ$ we can get another color coordinate (u_2', v_2')

$$\Delta = \text{Square Root}((u_2' - u_1')^2 + (v_2' - v_1')^2)$$

JNCD stands for "Just Noticeable Color Difference"

For the (u', v') color space 1 JNCD=0.0040

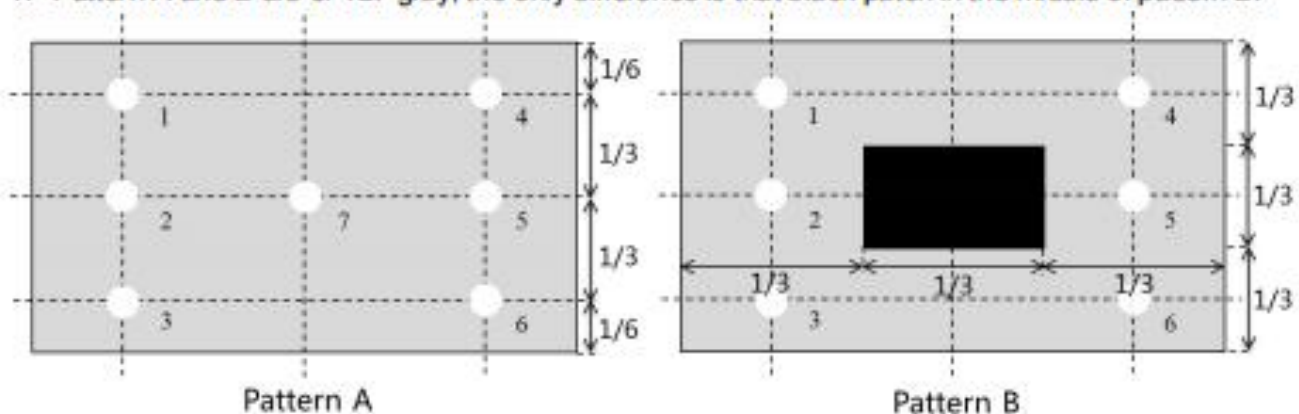
5 JNCD means $\Delta u'v' < 0.020$.

This Requirement is from our customer and we have test some of our phone display and the result is OK.

Note9: Crosstalk

For crosstalk measure, EDO's request as below.

1. Pattern A and B are of 127 gray, the only difference is that black patch in the middle of pattern B.



2. Calibrate the test instrument.
3. Point 7 in pattern A is used as brightness calibration for each panel. Then measure the brightness of points 1 to 6 in pattern A and B.
4. Calculate the value of crosstalk according to the formula:
$$\text{Crosstalk} = \max\{((B_2 - A_2) - [(B_1 - A_1) + (B_3 - A_3)]/2)/A_2; ((B_5 - A_5) - [(B_4 - A_4) + (B_6 - A_6)]/2)/A_5\}.$$

Note10: TUV blue ray certification

Under full white mode, test the spectra of center point, and then calculate the intensity in the range 415nm - 455nm and 400nm - 500nm. The ratio of intensity from 415nm - 455nm compared to 400nm - 500nm should be less than 50%.

Note11: OLED Life Time

The test procedure is as follows:

At room temperature(25°C), light the module with typical value brightness(Full white). After that, record the brightness of center point every 24 hours. Then test 600 hours or more to collect the raw data. Finally, use the raw data and the specific formulas to calculate and estimate the T50.

5. AMOLED Electrical Characteristics

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

Characteristics	Symbol	Min.	Max.	Unit
Supply Voltage	VBAT	-0.3	30	V
Operating temperature	T _{OP}	-20	+70	°C
Storage temperature	T _{ST}	-40	+85	°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.

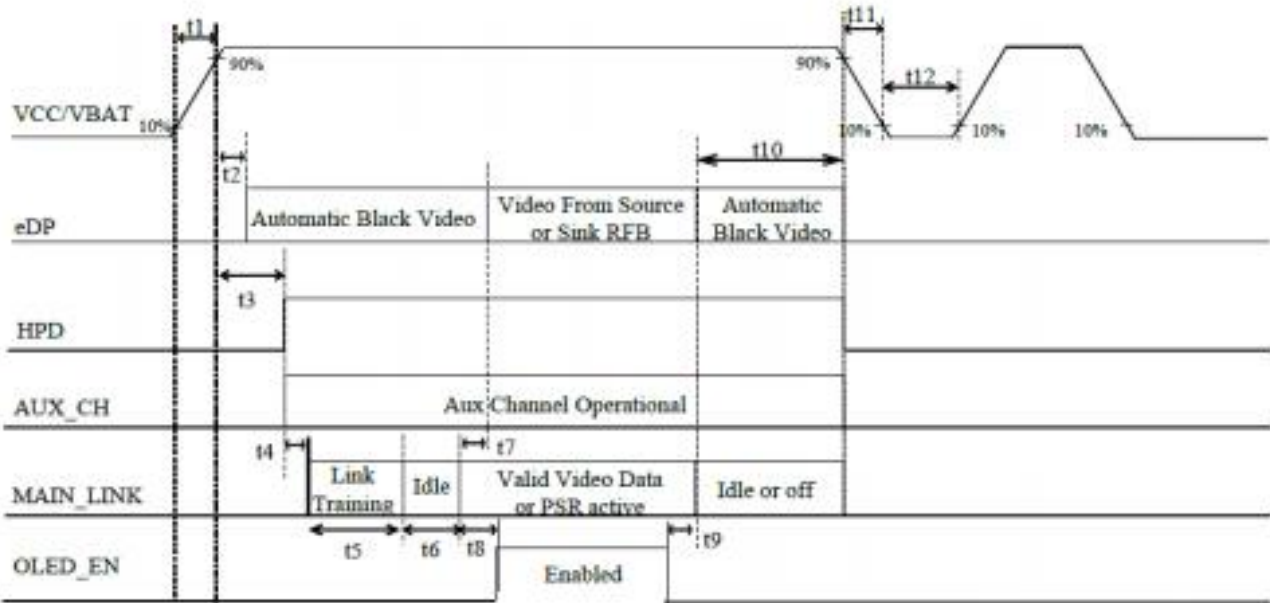
5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	VBAT	21.6	24	26.4	V	--
Normal mode Current consumption	VBAT	Full white VBAT=24V	1458	1604	mA	--
Power Consumption	VBAT		35	38.5	W	--
Frame Frequency	Fps	-	-	60	Hz	

Note(1): Full White pattern, Temperature = 22±3℃ Room Temperature

6. AC Characteristic

6.1 Recommended Operating Sequence



- ◆ It needs minimum 1200ms HPD~Valid Video Data(T4-T6). During the period display back data and valid video data before 1200ms can be lost.
- ◆ Do not keep the interface signal high-impedance or unusual signal when power is on.

Symbol	Min	Max	Unit	Description
t1	0.5	10	ms	Power rail rise time, 10 to 90%
t2	0	200	ms	Delay from VCC/VBAT to automatic Black Video
t3	0	200	ms	Delay from VCC/VBAT to HPD high
t4	-	-	ms	Allows for the Source device to read Link capability
t5	-	-	ms	Link Training duration
t6	-	-	ms	Link idle
t7	0	50	ms	Delay from valid video data from Source to video on display
t8	20	-	ms	Delay from valid video data from Source device to OLED_EN
t9	0	-	ms	Delay from OLED disable to end of valid video data
t10	0	500	ms	Delay from end of valid video data from the Source to power-off
t11	-	10	ms	Power rail fall time, 90 to 10%
t12	500	-	ms	Note

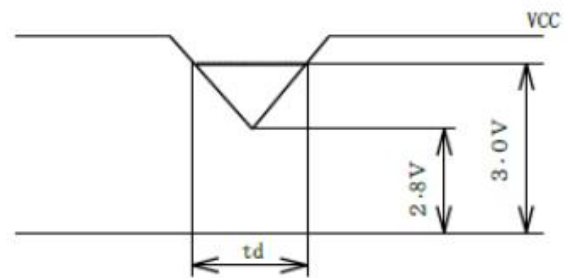
[Note] As for the power off-on sequence for VCC(t12), be sure to keep above mentioned timing. If the VCC power off-on sequence timing is other than shown above, Panel may cause permanent damage.

VCC-dip Condition

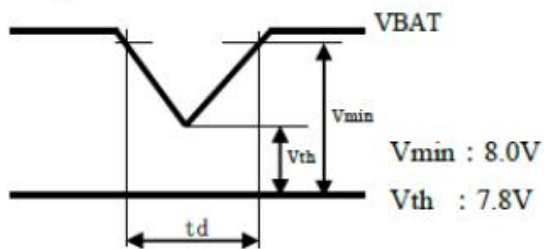
- 1) $2.8\text{ V} \leq V_{CC} < 3.0\text{ V}$
 $t_d \leq 10\text{ ms}$

Under above condition, the display image should return to an appropriate figure after VCC voltage recovers.

- 2) $V_{CC} < 2.8\text{ V}$
VCC-dip conditions should also follow the ON-OFF conditions for supply voltage



VBAT-dip Condition



- 1) $V_{th} \leq V_{BAT} < V_{min} : t_d \leq 20\text{ms}$
- 2) $V_{BAT} < V_{th}$: The condition of instantaneous voltage drop is apply to display exception

6.2 EDP interface Timing Characteristics

Resolution	3840(H) × 2160(V)	
eDP Speed	Typ	5.4 Gbps
Frame Freq.	Typ	60 Hz
Porch	HFP + HBP (with HS)	160
	VFP + VBP (with VS)	48

7. CTP Specification

7.1 Electrical Characteristics

7.1.1 Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Note
I2C Power Supply Voltage	VDD	-0.3	3.6	V	
USB Power Supply Voltage	VBUS	-0.3	6.0	V	
Operating temperature	T _{OP}	-20	+70	°C	
Storage temperature	T _{ST}	-40	+85	°C	

7.1.2 DC Electrical Characteristics (Ta=25°C)

(Ambient temperature:25°C , VDD=2.8V, VDDIO=1.8V or VDDIO=VDD)

Item	Min.	Typ.	Max.	Unit	Note
I2C Power Supply Voltage	3.0	3.3	3.6	V	
USB Power Supply Voltage	4.4	5	5.5		
Normal mode operating current	--	100		mA	
Digital Input low voltage/VIL	0	--	0.3*VDDIO	V	
Digital Input high voltage/VIH	0.6*VDDIO	--	VDDIO+0.5	V	
Digital Output low voltage/VOL	0.7*VDDIO	--	--	V	
Digital Output high voltage/VOH	--	--	0.3*VDDIO	V	

7.1.3 USB DC Electrical Characteristics

Item	Symbol	Min	Typ.	Max	Unit	Condition
Input Low	V_{IL}			0.8	V	
Input High (driven)	V_{IH}	2.0			V	
Differential input sensitivity	V_{DI}	0.2			V	(D+) – (D-)
Differential common-mode range	V_{CM}	0.8		2.5	V	Includes V_{DI} range
Single-ended receiver threshold	V_{SE}	0.8		2.0	V	
Receiver hysteresis	V_{RH}		200		mV	
Output low (driven)	V_{OL}	0		0.3	V	
Output high (driven)	V_{OH}	2.8		3.6	V	
Output signal cross voltage	V_{CRS}	1.3		2.0	V	
Pull-up resistor	R_{PU}	1.425		1.575	k Ω	
Pull-down resistor	R_{PD}	14.25		15.75	k Ω	
Termination Voltage for upstream port pull up (RPU)	V_{TRM}	3.0		3.6	V	

7.2 I2C AC Characteristics

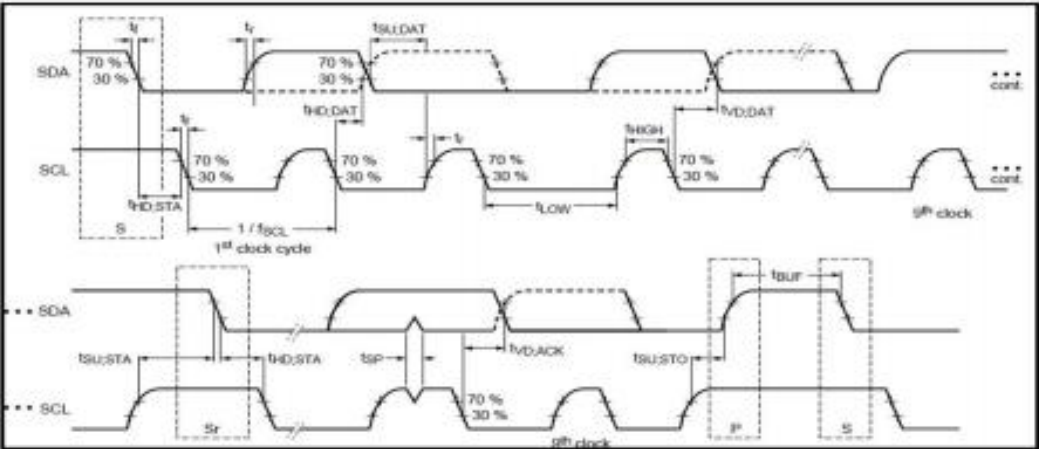


Table 5-7: I2C DC Characteristics

Parameter	Symbol	Standard-mode		Fast-mode		Unit
		Min	Max	Min	Max	
SCL clock frequency	f_{SCL}	0	100	0	400	kHz
Hold time START condition	$t_{HD,STA}$	4.0	-	0.6	-	us
LOW period of the SCL clock	t_{LOW}	4.7	-	1.3	-	us
HIGH period of the SCL clock	t_{HIGH}	4.0	-	0.6	-	us
Set-up time for a repeated START condition	$t_{SU,STA}$	4.7	-	0.6	-	us
Data hold time	$t_{HD,DAT}$	300	-	300	-	ns
Data set-up time	$t_{SU,DAT}$	250	-	100	-	ns
Rise time of both SDA and SCL signals (30% to 70%)	t_r	-	1000	20	300	ns
Fall time of both SDA and SCL signals (70% to 30%)	t_f	-	300	20	300	ns
Set-up time for STOP condition	$t_{SU,STO}$	4.0	-	0.6	-	us
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	1.3	-	us
Capacitive load for each bus line	C_b	-	400	-	400	pF
Noise margin at the LOW level for each connected device	V_{NL}	$0.1V_{DD}$	-	$0.1V_{DD}$	-	V
Noise margin at the HIGH level for each connected device	V_{NH}	$0.2V_{DD}$	-	$0.2V_{DD}$	-	V

*SCL = I2C Host must to support clock stretching mode for using 400 kHz.

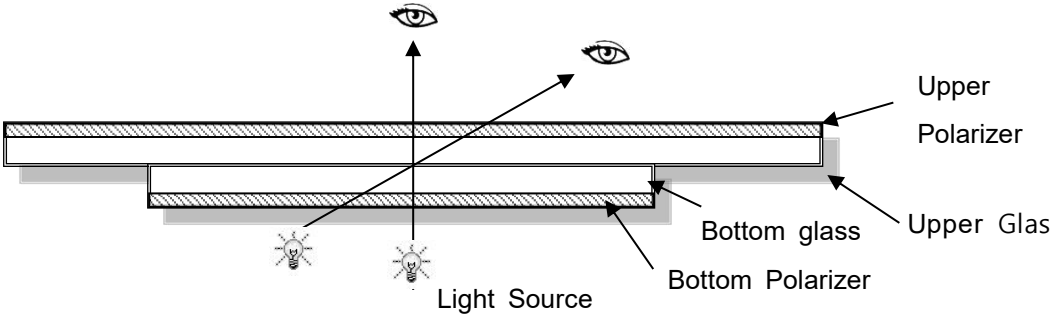
8. AMOLED Module Out-Going Quality Level

8.1 VISUAL & FUNCTION INSPECTION STANDARD

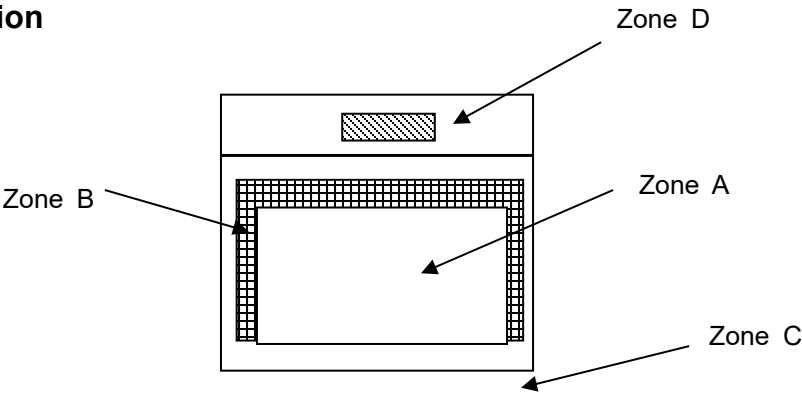
8.1.1 Inspection conditions

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



8.1.2 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

8.1.3 Sampling Plan

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

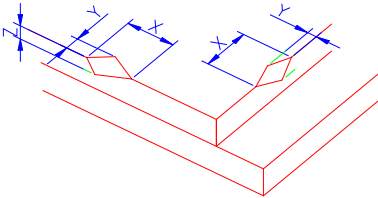
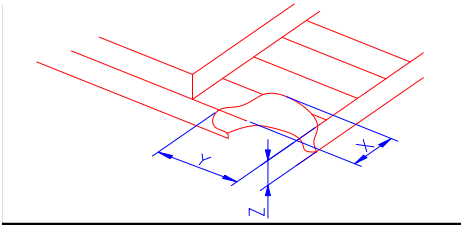
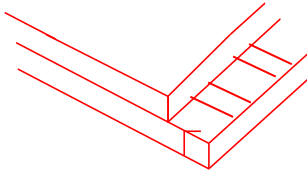
Major defect	Minor defect
0.65	1.5

AMOLED: Liquid Crystal Display , LCM: Liquid Crystal Module

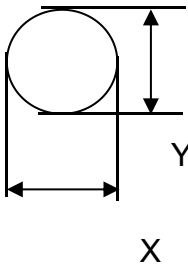
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc	Major
2	Missing	Missing components and etc	
3	Outline dimension	Overall outline dimension beyond the drawing 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	AMOLED/Polarizer	Black/White spot/line, scratch, crack, etc.	

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

8.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 AMOLED Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of IT O, T: Height of AM OLED	(1) The edge of AMO LED 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)AMOLED 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) AMOLED crack	 Crack Not allowed							

Spot defect



2.0

Y

X

$\Phi=(X+Y)/2$

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

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore	Ignore	
$0.15 < \Phi \leq 0.25$	3(distance $\geq 10\text{mm}$)		
$0.25 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$)		
$\Phi > 0.4$	0		

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

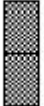
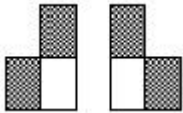
Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore	Ignore	
$0.15 < \Phi \leq 0.25$	3(distance $\geq 10\text{mm}$)		
$0.25 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$)		
$\Phi > 0.4$	0		

③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		Ignore
$0.2 < \Phi \leq 0.5$	2(distance $\geq 10\text{mm}$)		
$\Phi > 0.5$	0		

④Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		Ignore
$0.2 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$)		
$\Phi > 0.4$	0		

3.0	AMOLED Pixel defect	Pixel bad points <table border="1" data-bbox="539 309 1497 1057"> <thead> <tr> <th data-bbox="539 309 730 360">Item</th><th data-bbox="730 309 1244 360">Zone A</th><th data-bbox="1244 309 1497 360">Acceptable Qt</th></tr> </thead> <tbody> <tr> <td data-bbox="539 360 730 521" rowspan="3">Bright dot</td><td data-bbox="730 360 1244 416">Random</td><td data-bbox="1244 360 1497 416">$N \leq 2$</td></tr> <tr> <td data-bbox="730 416 1244 472">2 dots adjacent</td><td data-bbox="1244 416 1497 472">$N \leq 0$</td></tr> <tr> <td data-bbox="730 472 1244 521">3 dots adjacent</td><td data-bbox="1244 472 1497 521">$N \leq 0$</td></tr> <tr> <td data-bbox="539 521 730 689" rowspan="3">Dark dot</td><td data-bbox="730 521 1244 577">Random</td><td data-bbox="1244 521 1497 577">$N \leq 3$</td></tr> <tr> <td data-bbox="730 577 1244 633">2 dots adjacent</td><td data-bbox="1244 577 1497 633">$N \leq 0$</td></tr> <tr> <td data-bbox="730 633 1244 689">3 dots adjacent</td><td data-bbox="1244 633 1497 689">$N \leq 0$</td></tr> <tr> <td data-bbox="539 689 730 999">Distance</td><td data-bbox="730 689 1244 999"> 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. </td><td data-bbox="1244 689 1497 999">5mm</td></tr> <tr> <td colspan="2" data-bbox="539 999 1244 1057">Total bright and dark dot</td><td data-bbox="1244 999 1497 1057">$N \leq 4$</td></tr> </tbody> </table> Note: A) Bright dot: Dots appear bright and unchanged in size in which AMOLED panel is displaying under black pattern. B) Dark dot: Dots appear dark and unchanged in size in which AMOLED 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		$N \leq 4$
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	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 (AMOLED /Polarizer backlight black/white line, scratch, stain)  W: width, L : length N : Count	<table><tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(m)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi \leq 0.05$</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.05 < W \leq 0.06$</td><td>$L \leq 5.0$</td><td colspan="2">$N \leq 3$</td></tr><tr><td>$0.06 < W \leq 0.08$</td><td>$L \leq 4.0$</td><td colspan="2">$N \leq 2$</td></tr><tr><td>$W > 0.08$</td><td colspan="4">Define as spot defect</td></tr></table>	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			
Width(mm)	Length(m)	Acceptable Qty																										
		A	B	C																								
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$0.06 < W \leq 0.08$	$L \leq 4.0$	$N \leq 2$																										
$W > 0.08$	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	AMOLED 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

9. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	70°C,300HR	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the AMOLED; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-20°C, 300HR	
High Temperature Storage	85°C, 300HR	
Low Temperature Storage	-40°C, 300HR	
High Temperature & High Humidity Storage	+60°C, 93% RH ,96 hours.	
Thermal Shock (Non-operation)	-40°C,30 min ↔ 85°C,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±15KV, 5times; Contact:±10KV, 5 times;	
Vibration (Non-operation)	1.5Grma 10~500Hz Random X Y Z 1H	
Packing Drop(Non-operation)	60cm height, 6-faces, 3-edges and	

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.

10. Cautions and Handling Precautions

10.1 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

10.2 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 AMOLED 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.

Part. No	ID-270UDOEN003-C002B	REV	V1.1	Page 31 of 32
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11. Packing

----TBD-----