

SPECIFICATION FOR AMOLED+CG Module

MODULE No:	ID-145OLEDN003-C003A
CUSTOMER:	

I-DISPLAY	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

[illegible]

Part. No	ID-145OLEDN003-C003A	REV	V1.0	Page 2 of 32
----------	----------------------	-----	------	--------------

Contents

1. Description	4
2. Features	4
2.1 Product Applications	4
2.2 Product Features	4
3. Mechanical Specifications	4
4. Outline dimension	5
5. Input terminal Pin Assignment	6
6. Electro-Optical Specification	10
6.1 Optical specification	10
7. Electrical Characteristics	15
7.1 Absolute Maximum Rating	15
7.2 DC Electrical Characteristics	15
7.3 TP IC Recommended Operating Conditions for whole set	17
7.4 Graphic memory writing direction	17
7.5 Recommended Operating Sequence	18
7.5.1 Power on sequence	18
7.5.2 Power on sequence	18
7.5.3 High-speed receiver	19
7.5.4 TP SPI	19
8. Touch Sensor Specification	21
9. Module Out-Going Quality Level	23
9.1 VISUAL & FUNCTION INSPECTION STANDARD	23
9.1.1 Inspection conditions	23
9.1.2 Definition	23
9.1.3 Sampling Plan	24
9.1.4 Criteria (Visual)	25
10. Reliability Test Result	30
11. Cautions and Handling Precautions	31
11.1 Handling and Operating the Module	31
11.2 Storage and Transportation	31
12. Packing	32

1. Description

The resolution of a 14.5” AMOLED contains 3000X1876 pixels, and can display up to 1.07B (RGB x 10bits) colors.

2. Features

2.1 Product Applications

Tablet, notebook, portable GPS, handheld game console...

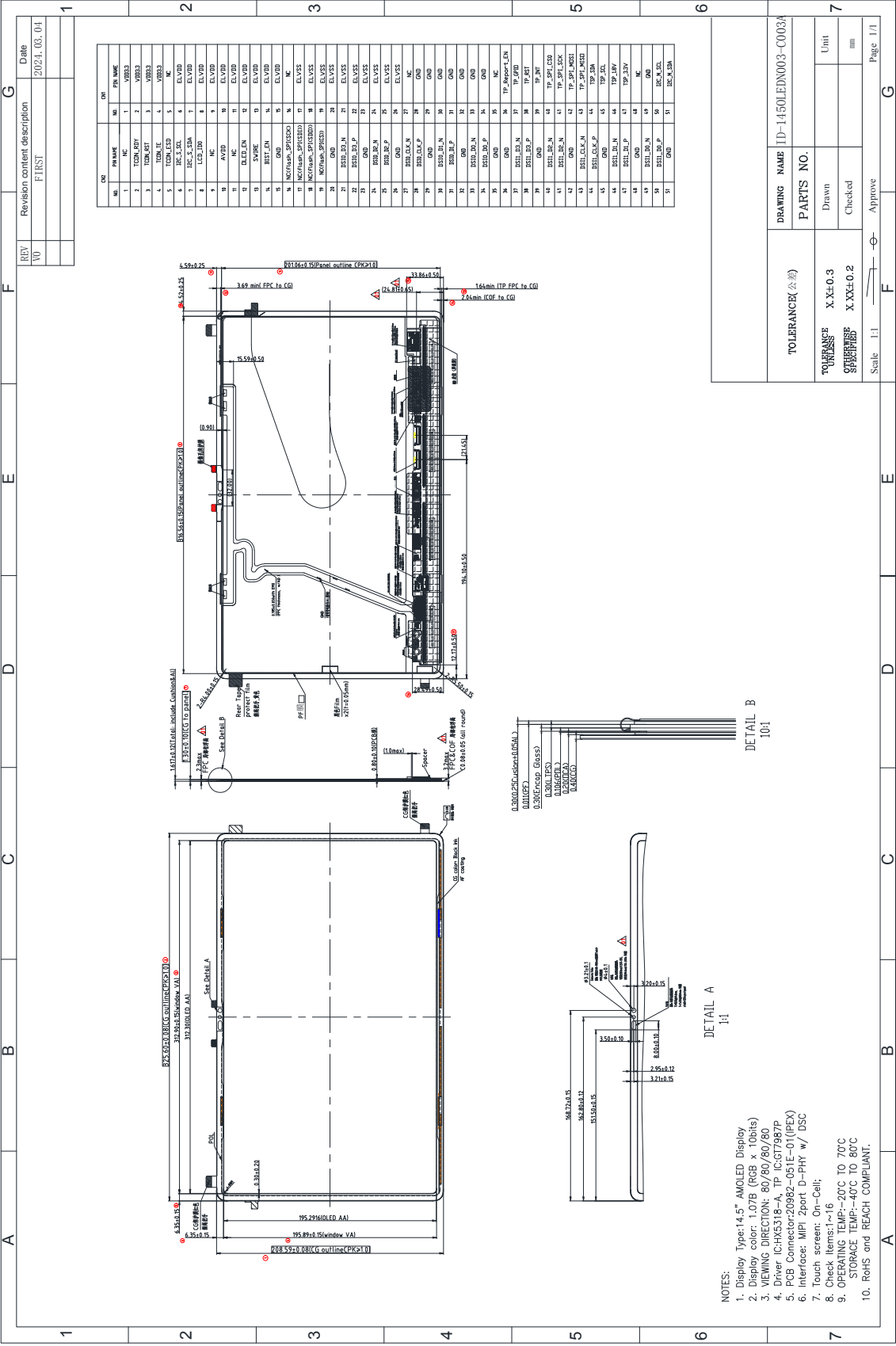
2.2 Product Features

- 2.2.1 Display color: 1.07B (RGB x 10bits)
- 2.2.2 Display format: 14.5” (3000RGBx1876)
- 2.2.3 Pixel arrangement: Real RGB
- 2.2.4 Interface: MIPI 2port D-PHY w/ DSC
- 2.2.5 Source IC : HX5318 * 4
- 2.2.6 TCON IC : HX5329
- 2.2.7 Touch screen: On-Cell; Touch IC: GT7987P
- 2.2.8 Module type: FOG+OCA+CG

3. Mechanical Specifications

General Information Items	Specification	Unit	Note
	Main Panel		
Dimension outline	316.56*201.0616 LTPS outline	mm	
Resolution	3000 RGB * 1876	dots	
Active area	312.3*195.2916	mm	
Diagonal size	14.5	inch	
Pixel pitch	0.1041*0.1041	mm	
Panel thickness	0.3/0.011/0.3/0.3/0.13	mm	
Weight	235g±3	g	
Operating temperature	-20~+70	℃	
Storage temperature	-40~+80	℃	

4. Outline dimension



Part. No	ID-145OLEDN003-C003A	REV	V1.0	Page 5 of 32
----------	----------------------	-----	------	--------------

5. Input terminal Pin Assignment

(Connector:FH41-60S-0.5SH)

CN1: Touch

NO.	SYMBOL	DISCRIPTION	I/O
1	VDD3.3	Power supply for PMIC&DDIC circuit	P
2	VDD3.3	Power supply for PMIC&DDIC circuit	P
3	VDD3.3	Power supply for PMIC&DDIC circuit	P
4	VDD3.3	Power supply for PMIC&DDIC circuit	P
5	NC	No connect	--
6	ELVDD	AMOLED Power Positive	P
7	ELVDD	AMOLED Power Positive	P
8	ELVDD	AMOLED Power Positive	P
9	ELVDD	AMOLED Power Positive	P
10	ELVDD	AMOLED Power Positive	P
11	ELVDD	AMOLED Power Positive	P
12	ELVDD	AMOLED Power Positive	P
13	ELVDD	AMOLED Power Positive	P
14	ELVDD	AMOLED Power Positive	P
15	ELVDD	AMOLED Power Positive	P
16	NC	No connect	--
17	ELVSS	AMOLED power Negative	P
18	ELVSS	AMOLED power Negative	P
19	ELVSS	AMOLED power Negative	P
20	ELVSS	AMOLED power Negative	P
21	ELVSS	AMOLED power Negative	P
22	ELVSS	AMOLED power Negative	P
23	ELVSS	AMOLED power Negative	P
24	ELVSS	AMOLED power Negative	P
25	ELVSS	AMOLED power Negative	P
26	ELVSS	AMOLED power Negative	P

27	NC	No connect	--
28	GND	Ground	P
29	GND	Ground	P
30	GND	Ground	P
31	GND	Ground	P
32	GND	Ground	P
33	GND	Ground	P
34	GND	Ground	P
35	NC	No connect	--
36	TP_Report_EN	Reserve pin	I/O
37	TP_GPIO	I2C/SPI select	I/O
38	TP_RST	TP reset(1.8V)	I/O
39	TP_INT	TP interrupt for AP(1.8V)	I/O
40	TP_SPI_CS0	TP Slave select for SPI (Serial Peripheral Interface)(1.8V)	I/O
41	TP_SPI_SCK	TP Slave clock for SPI (Serial Peripheral Interface)(1.8V)	I/O
42	TP_SPI_MOSI	TP Master output, slave input for SPI (Serial Peripheral Interface)(1.8V)	I/O
43	TP_SPI_MISO	TP Master input, slave output for SPI (Serial Peripheral Interface)(1.8V)	I/O
44	TP_SDA	Reserve pin	I/O
45	TP_SCL	Reserve pin	I/O
46	TP_1.8V	Digital Power Supply For TP (TYP.1.8V)	P
47	TP_3.3V	Analog Power Supply For TP (TYP.3.3V)	P
48	NC	No connect	--
49	GND	Ground	P
50	I2C_M_SCL	(I2C) SCL clock I/O pin for PMIC (Choosing one of I2C channel and Swire)	I/O
51	I2C_M_SDA	(I2C) SDA data I/O pin for PMIC (Choosing one of I2C channel and Swire)	I/O

CN2: Module

NO.	SYMBOL	DISCRIPTION	I/O
1	NC	No connect	--
2	TCON_RDY	TCON ready to SOC	I/O
3	TCON_RST	TCON reset(Low active)	I/O
4	TCON_TE	Tearing effect	I/O
5	TCON_ESD	TCON ESD error detected to SOC	I/O
6	I2C_S_SCL	(I2C) SCL clock I/O pin	I/O
7	I2C_S_SDA	(I2C) SDA data I/O pin	I/O
8	LCD_ID0	Output pin of LCD_ID0, connctet 1.8V	I/O
9	NC	No connect	--
10	AVDD	Power supply for DDIC Analog system	P
11	NC	No connect	--
12	OLED_EN	Enable OLED signal to PMIC	I/O
13	SWIRE	Swire protocol setting pin of power IC (Choosing one of I2C channel and Swire)	I/O
14	BIST_EN	Reserve pin ,If not used, please open this pin.	I/O
15	GND	Ground	P
16	NC(flash_SPI(SCK))	Reserve pin ,If not used, please open this pin.	--
17	NC(flash_SPI(SDI))	Reserve pin ,If not used, please open this pin.	--
18	NC(flash_SPI(SDO))	Reserve pin ,If not used, please open this pin.	--
19	NC(flash_SPI(CS))	Reserve pin ,If not used, please open this pin.	--
20	GND	Ground	P
21	DSI0_D3_N	MIPI DSI0 data3-	I/O
22	DSI0_D3_P	MIPI DSI0 data3+	I/O
23	GND	Ground	P
24	DSI0_D2_N	MIPI DSI0 data2-	I/O
25	DSI0_D2_P	MIPI DSI0 data2+	I/O
26	GND	Ground	P
27	DSI0_CLK_N	MIPI DSI0 Clock-	I/O
28	DSI0_CLK_P	MIPI DSI0 Clock+	I/O

29	GND	Ground	P
30	DSI0_D1_N	MIPI DSI0 data1-	I/O
31	DSI0_D1_P	MIPI DSI0 data1+	I/O
32	GND	Ground	P
33	DSI0_D0_N	MIPI DSI0 data0-	I/O
34	DSI0_D0_P	MIPI DSI0 data0+	I/O
35	GND	Ground	P
36	GND	Ground	P
37	DSI1_D3_N	MIPI DSI1 data3-	I/O
38	DSI1_D3_P	MIPI DSI1 data3+	I/O
39	GND	Ground	P
40	DSI1_D2_N	MIPI DSI1 data2-	I/O
41	DSI1_D2_P	MIPI DSI1 data2+	I/O
42	GND	Ground	P
43	DSI1_CLK_N	MIPI DSI1 Clock-	I/O
44	DSI1_CLK_P	MIPI DSI1 Clock+	I/O
45	GND	Ground	P
46	DSI1_D1_N	MIPI DSI1 data1-	I/O
47	DSI1_D1_P	MIPI DSI1 data1+	I/O
48	GND	Ground	P
49	DSI1_D0_N	MIPI DSI1 data0-	I/O
50	DSI1_D0_P	MIPI DSI1 data0+	I/O
51	GND	Ground	P

6. Electro-Optical Specification

6.1 Optical specification

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit.	Note
Brightness			Full White,Center	360	400	440	cd/m2	(1)
HBM			--	450	500	550	cd/m2	(1)
Minimum Brightness			no flicker	--	4	5	cd/m2	
Brightness Uniformity			Full White	720	800	880	%	(2)
Contrast Ratio		CR	Normal to surface	60000	--	--	--	(3)
Color Filter Chromaticity	White	W _X		-0.04	0.295	+0.04		
		W _Y			0.315			
	Red	R _X			0.683			
		R _Y			0.317			
	Green	G _X			0.235			
		G _Y			0.734			
	Blue	B _X			0.138			
		B _Y			0.044			
Color Gamut(CIE 1931)			vs. NTSC	100	110	--	%	
CCT			--	7000	7800	8600	K	
CCT Range			--	--	--	900	K	
Viewing angle			U/D/L/R CR≥10	80	--	--	°	
Color shift			@ 45 degree	--	--	4.5	JNCD	(4)
Cross-talk			△CT	--	--	2	%	(5)
Gamma (120Hz&60Hz)			Normal~HBM	2	2.2	2.4	16~240 Gray	
				1.9	2.2	2.5	9~15 Gray	
			30~400nit	1.9	2.2	2.5	32~240 Gray	
			4~30nit	1.9	2.2	2.5	80~240 Gray	
Response time			--	--	--	2	ms	(6)

Flicker	Normal $\Theta=\Phi=0^\circ$	--	--	-40	dB	(7)
Lifetime @400nits	T50	10000	--	--	h	
	T95	500	--	--	h	
Short-burn in		240h $\geq 93\%$ @25°C 72h $\geq 93\%$ @50°C				(8)
Image retention	W128 preheat for 5min, Switch black and white screen display 10min later switch back to W128, Monitor brightness changes and record JND=1.5 time consuming			90	Sec	(9)
Upper Pol compensation film	Benq130um	HC/3	--	--		

Note1: Temp.25℃, (Angle、 distance)

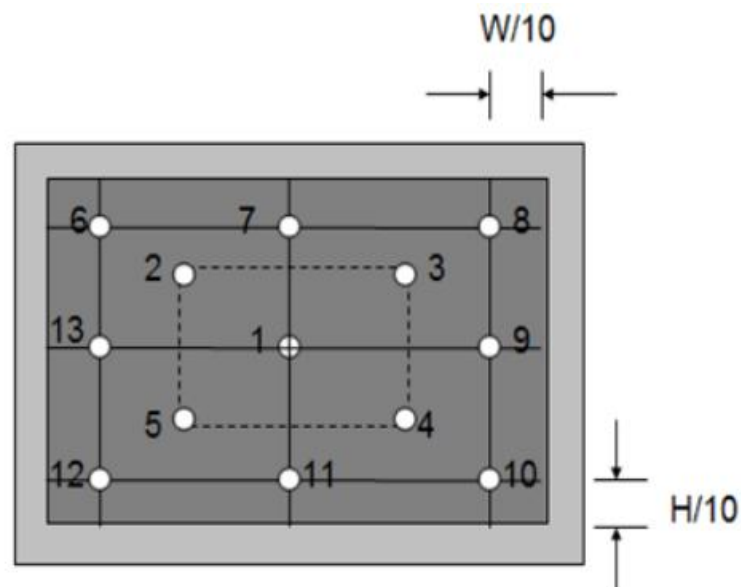
Environmental conditions : Temp.25℃ $\pm$ 3℃, 65 $\pm$ 20%RH, Dark Room.

Distance of OLED display center to measuring machine is 50cm.

Note2: Brightness Uniformity definition

Measure 13 points of Display Brightness,

Brightness Uniformity=Lmin/LMax $\times$ 100%



Note3: Contrast Ratio

Dark Room C.R=LW/LB

LW: full white brightness of display center P0;

LB : full black brightness of display center P0.

Part. No	ID-145OLEDN003-C003A	REV	V1.0	Page 11 of 32
----------	----------------------	-----	------	---------------

Note4: Color Shift

Out-spec panel(4.5~5.5JNCD) should be less than 5%

Note5: Cross-talk

- Measurement equipment: CS2000 or similar equipments
 - The point should be marked is, the background of Cross-talk Test Pattern-“gray “ are defined as middle gray scale .
- For example, RGB 24bit “gray” defined as below:

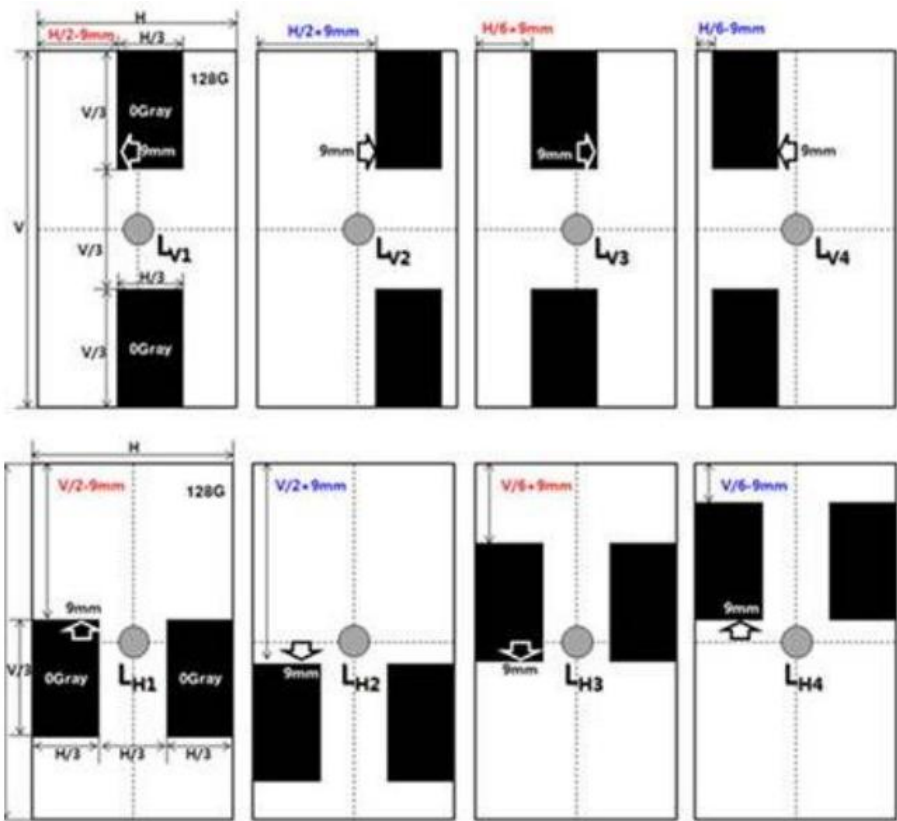
R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

- Test pattern follow below picture, the background is middle gray and with two black rectangle parts, each one is 1/9 of the AA size.
- Calculate the crosstalk(V) and crosstalk(H) with the test formula below:

$$Crosstalk(V) = \max \left(\left| \frac{L_{V1} - L_{V2}}{L_{V2}} \right| \times 100, \left| \frac{L_{V3} - L_{V4}}{L_{V4}} \right| \times 100 \right)$$

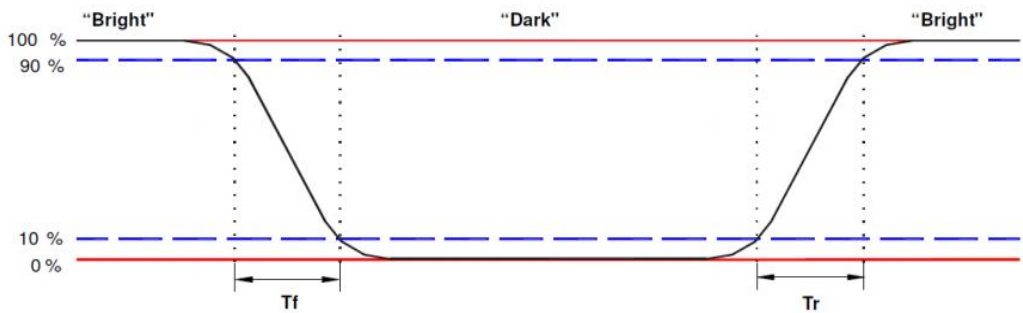
$$Crosstalk(H) = \max \left(\left| \frac{L_{H1} - L_{H2}}{L_{H2}} \right| \times 100, \left| \frac{L_{H3} - L_{H4}}{L_{H4}} \right| \times 100 \right)$$

- Then use the max value between Crosstalk(V) and Crosstalk(H) as the final crosstalk.



Note6: Response Time

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



Note 7: Flicker

Suggested Instruments: **Konica Minolta CA-310** or **Klein Instruments K-8**

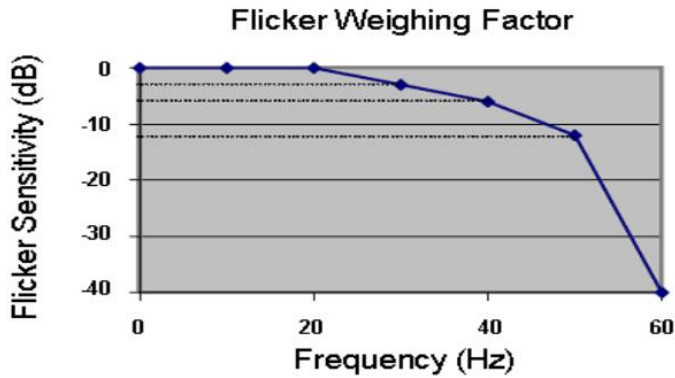


The flicker level is defined by **Fast Fourier Transformation (FTT)** as follows:

$$Flicker = 20 \log_{10} \left(2 \frac{f_{FFTC}(n)}{f_{FFTC}(0)} \right) + FS(Hz) \quad (dB)$$

Where
 $f_{FFTC}(n)$ is the n-th FFT coefficient.
 $f_{FFTC}(0)$ is the 0-th FFT coefficient which is DC component.
 $FS(Hz)$ is the flicker sensitivity as a function of frequency.

The peak flicker level shall be reported based on the calculation using above formula in which $FS(Hz)$ is determined by the flicker weighing factor shown below.



Note8 Short-burn in

To measure the burn-in effect, a test pattern with full white background (area B) and a black circle (area A) is applied to the AMOLED display at 400 nits setting with ACL off. The area of the black circle should not exceed the 20% of the whole displayed area and is big enough for brightness measurement.



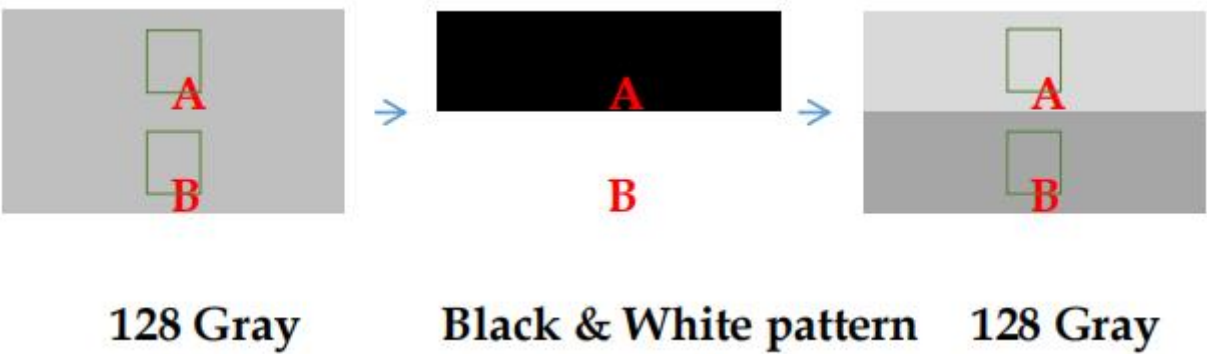
After the minimum time specied below (e.g. 200 hours), a full white image is applied on the display, and the luminance in area A and B are measured at 25℃and compared according to the change rate dened as:

$$1-\{A_{200hrs}/A_{0hr}-B_{200hr}/B_{0hr}\}$$

5 display samples should to be measured (all of samples have better luminance than this value)

Note9 Image retention

Light on a 128 gray pattern for 5 minutes, capture the luminance of A and B (LA / LB), Change to a Black & White pattern, and light on this pattern for 10 minutes; Then change the pattern back to 128 gray, at same time start to use CA310 (or similar optical device) measures the luminance of A and B(LA' / LB'), measure 180 times and each interval step is 1.2sec;



Calculate the JND as below method: $JND=|(LB'-LA')/(LB'+LA')-(LB-LA)/(LB+LA)| / 0.004$,Record the time which satisfy the JND value less than 1.5;

7. Electrical Characteristics

7.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit
Analog Power supply	VDD/VCI	-0.3	4.0	V
Analog Power supply	AVDD	-0.3	8.8	V
TP Power supply	TP_AVDD	-0.3	3.9	V
Operating temperature	T _{OP}	-20	+70	℃
Storage temperature	T _{ST}	-40	+80	℃

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.

7.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Remark
TP Power supply	TP_AVDD	3.0	3.3	3.4	V	Note1
Logic Power supply	VDD/VCI	3.0	3.3	3.6	V	--
Analog Power supply	AVDD	7	7.3	7.6	V	--
AMOLED Power Positive	ELVDD	4.55	4.6	4.65	V	DC/DC output
AMOLED power Negative	ELVSS	-3.45	-3.5	-3.55	V	400nits
TP_AVDD Ripple				100	mV	--
AVDD Ripple				50	mV	--

Note 1:

a) For TP_AVDD, the continuous power supply capacity (rated current) of the LDO of the motherboard is not less than 250mA, and the OCP (overcurrent protection limit) is not less than 350mA, And when the current value lasts more than 1ms to reach the OCP value before the power supply is turned off (not once the current value reaches the OCP value, the power supply is turned off), that is, the overcurrent turn-off time is not less than 1ms.

- b) If the power supply resources of the mainboard allow, you are advised to power the touch module separately, System It is recommended that the power supply for the touch module be controllable during power-on or power-off.
- c) Pressure difference requirements: Under various conditions, the machine must meet the minimum pressure difference requirements of the power supply LDO. For example, the TP power supply is 3.0V, and the minimum pressure difference requirement of the LDO power supply of the whole machine is 0.2V, then the input of the LDO power supply of the whole machine cannot be lower than 3.2V. Especially when the whole machine is low, the battery voltage may drop, and the load capacity becomes worse. At this time, if the whole machine power supply does not meet the minimum pressure difference requirements of LDO, the pressure difference may be insufficient, resulting in unstable AVDD voltage, affecting the performance of the touch module.
- d) It is recommended not to string magnetic beads or inductors on TP_AVDD to prevent voltage drop. If TP_AVDD needs string resistance processing, it is recommended to string 0 ohms.

1) Normal Mode

Power Supply: AVDD=7.3V VCI=3.3V
Frame Frequency: Fframe =120HZ @ 25degC, Brightness 400 nits, Command Mode,

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 400nits VELVDD=4.6V VELVSS= -3.5V	IELVDD /LVSS	--	985	1120	mA	Ref
	IVDD/IVCI	--	419	433	mA	Ref
	IAVDD	--	50	58	mA	Ref

2) HBM Mode

Power Supply: AVDD=7.3V VCI=3.3V
Frame Frequency: Fframe =120HZ @ 25degC, Brightness 500 nits, Command Mode,

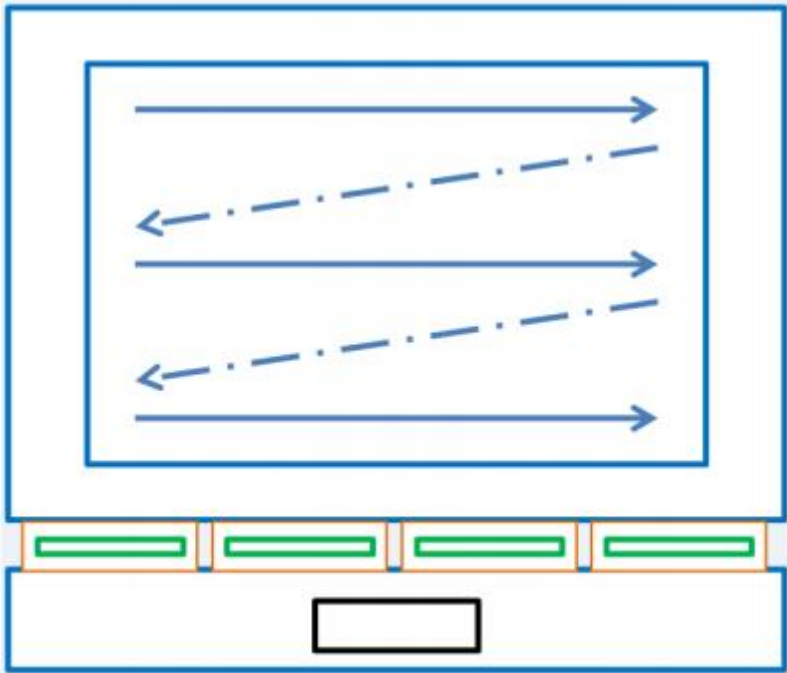
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Remark
100% Pixel On 500nits VELVDD=4.6V VELVSS= -3.5V	IELVDD /LVSS	--	1235	1400	mA	Ref
	IVDD/IVCI	--	425	436	mA	Ref
	IAVDD	--	50	60	mA	Ref

7.3 TP IC Recommended Operating Conditions for whole set

Power Supply: TP_AVDD=3.3V @ 25degC

Item(TP_AVDD)	Min.	Typ.	Max.	Unit
Finger Mode	--	55	60	mA
Finger Stylus Mode	--	36	40	mA
Gesture Mode	--	--	--	mA
Green Mode	--	18	25	mA
Sleep Mode	--	0.1	0.5	mA

7.4 Graphic memory writing direction



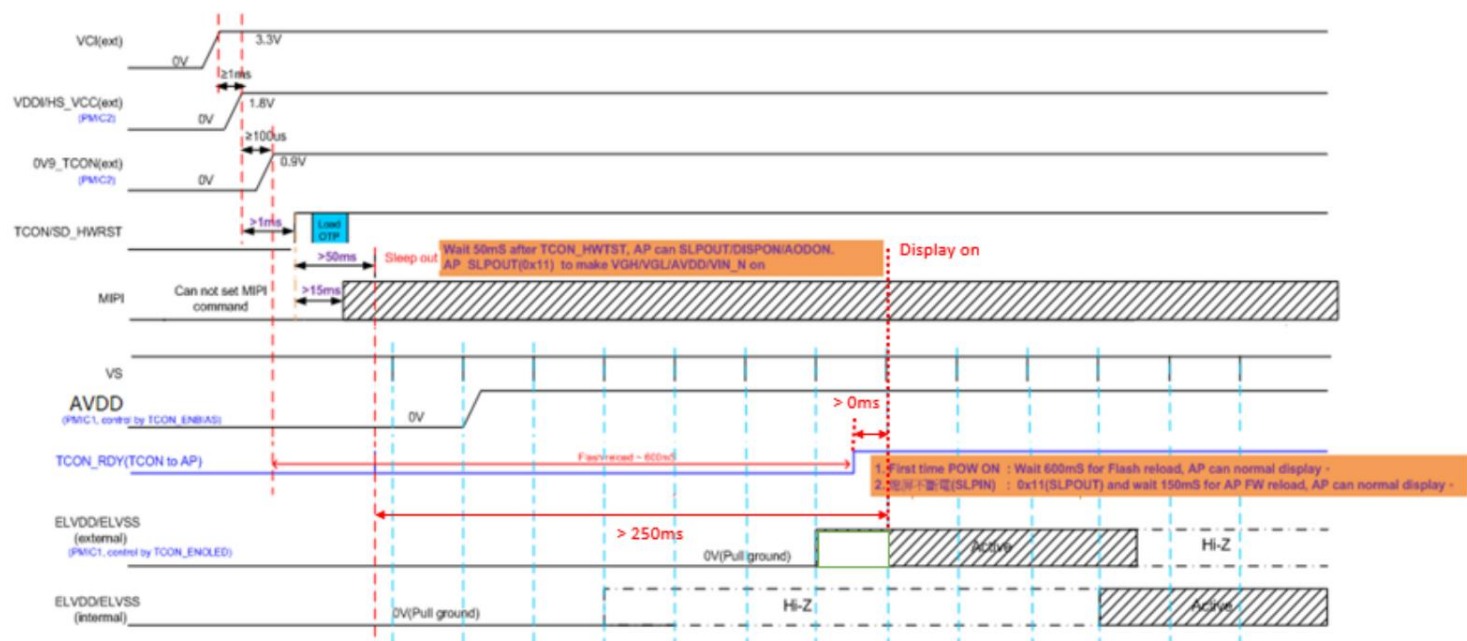
7.5 Recommended Operating Sequence

7.5.1 Power on sequence

External VDDI/VCI/VSP/VGH/VGL/VINI_N

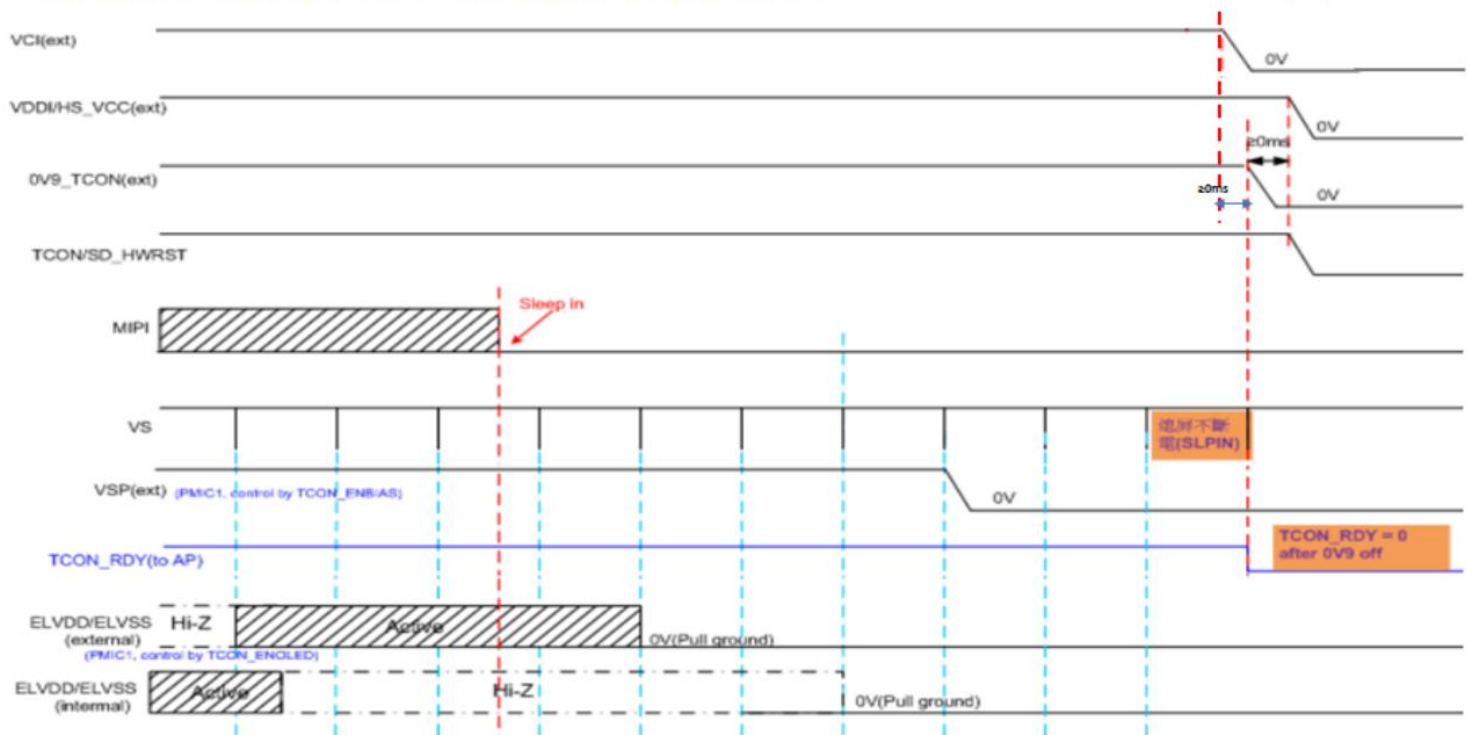
Power on sequence

External VDDI/VCI/VSP/VGH/VGL/VINI_N



7.5.2 Power on sequence

Power-off sequence (for internal used)
External VDDI/VCI/VSP/VGH/VGL/VINT1



7.5.3 High-speed receiver

Table 25 HS Receiver AC Specifications

Parameter	Description	Min	Nom	Max	Units	Notes
$\Delta V_{CMRX(HF)}$	Common-mode interference beyond 450 MHz			100	mV	2, 5
				50	mV	2, 6
$\Delta V_{CMRX(LF)}$	Common-mode interference 50MHz – 450MHz	-50		50	mV	1, 4, 5
		-25		25	mV	1, 4, 6
V_{IDTH}	Differential input high threshold			70	mV	5
				40	mV	6
V_{IDTL}	Differential input low threshold	-70			mV	5
		-40			mV	6
V_{IHHS}	Single-ended input high voltage			460	mV	7
V_{ILHS}	Single-ended input low voltage	-40			mV	7
$V_{TERM-EN}$	Single-ended threshold for HS termination enable			450	mV	
C_{CM}	Common-mode termination			60	pF	3

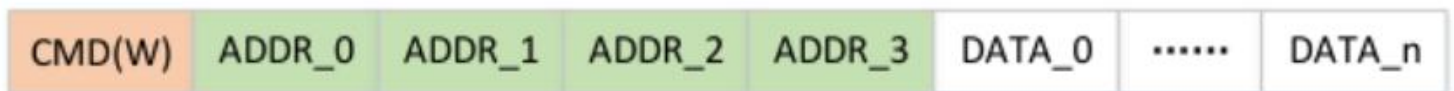
Note:

1. Excluding 'static' ground shift of 50mV
2. $\Delta V_{CMRX(HF)}$ is the peak amplitude of a sine wave superimposed on the receiver inputs.
3. For higher bit rates a 14pF capacitor will be needed to meet the common-mode return loss specification.
4. Voltage difference compared to the DC average common-mode potential.
5. For devices supporting data rates ≤ 1.5 Gbps.
6. For devices supporting data rates > 1.5 Gbps.
7. Excluding possible additional RF interference of 100mV peak sine wave beyond 450MHz.

7.5.4 TP SPI

GT7987P provides SPI interface, Only Mode0 (CPOL=0, CPHA=0) is supported. Mode1 (CPOL=0, CPHA=1), Mode2 (CPOL=1, CPHA=0), Mode3 (CPOL=1, CPHA=1) Four modes. By SPI_MOSI (slave data input), SPI_MISO (slave data output), SPI_CLK (clock), SPI_CS (slice selection) communicates with the master.

SPI write operation protocol



CMD(W): Write operation command, which is fixed to 0xF0

ADDR_0~ADDR_3: 32-bit address of the register to be written (big-endian mode: high byte first, low byte last)

DATA_0~DATA_n: Word data to be written

SPI read operation protocol

1.One Byte mode



CMD(R): Read operation command, fixed to 0xF1

ADDR_0~ADDR_3: 32-bit first address of the register to be read (big-endian mode: high byte first, low byte last)

DATA_0~DATA_n: Word data to be read

The data of each communication must be word-aligned data, automatically increments the register address, and sends subsequent data sequentially.

2.Two Byte mode



CMD(W): Write operation command, which is fixed to 0xF0

ADDR_0~ADDR_3: 32-bit first address of the register to be read (big-endian mode: high byte first, low byte last)

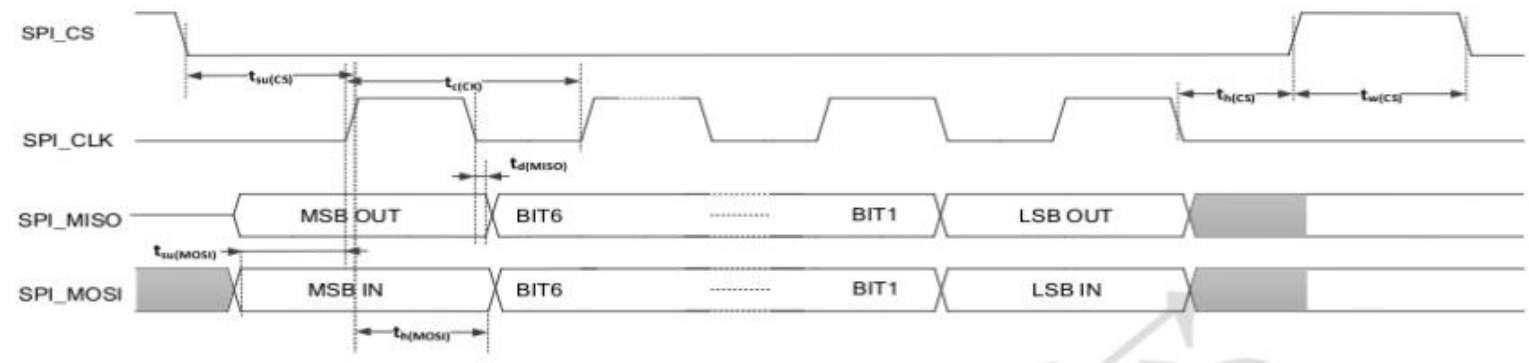
CMD(R): Read operation command, fixed to 0xF1

DATA_0~DATA_n: Word data to be read

The data of each communication must be word-aligned data, automatically increments the register address, and sends subsequent data sequentially.

SPI timing

The standard SPI: SPI_MISO (slave data output) starts to jump after a falling edge of SPI_CLK (clock). Mode0 (CPOL=0, CPHA=0) is used to describe the standard SPI timing.



8. Touch Sensor Specification

No	Item	Conditions	Unit	Remark
1	TP Structure	On-cell		
2	Touch D-IC	Goodix		
3	Sensor Substrate	Glass		
4	Sensor Sheet Resistance	≤ 33		
5	Number of touch	47*75		
6	Sensing Method	Mutual + Self Capacitance		
7	ITO Pitch	4.200	mm	
8	Accuracy	center 1.0/Border 1.5	mm	ϕ 6mm
9	Precision	center 1.0/Border 1.5	mm	ϕ 6mm
10	Linearity	center 1.0/Border 1.5	mm	ϕ 6mm
11	Jitter	<0.5	mm	ϕ 6mm
12	Response Time	<30	ms	
13	Finger Separation	<12	mm	
14	Sensitivity	ϕ 4	mm	
15	Report Rate	>100Hz@1Finger >80Hz@Muti-Finger		
16	Signal-to-Noise Raito	>30:1		
17	No Ghost input	Support		
18	Anti Water	Support		Note10
19	Temperature Shock Self-adaption	Support		Note11
20	Hover	Support		Note12
21	Palm Rejection	Support		Note13
22	Function Reset	Support		Note14
23	Gesture Support	Support		
24	Active Pen	Support at least MPP		

Note 10: Anti Water

TP works well under below condition:

1. Water-drop(Size ϕ 1mm) on the top of TP. 2.Spray on the top of TP.

Part. No	ID-145OLEDN003-C003A	REV	V1.0	Page 21 of 32
----------	----------------------	-----	------	---------------

Note 11: Temperature Shock Self-adaption

-20C to 50/10min. Check TP performance at -10C/25C/50C. TP should work well.

Note 12: Hover

φ7mm slug ,1mm distance to TP surface. No touch report .

Note 13: Palm Rejection

When 20cm palm on TP surface, no touch report and the reset area of TP still work well

Note 14: Function Reset

Execute Function Reset after power on and rouse the Pad.

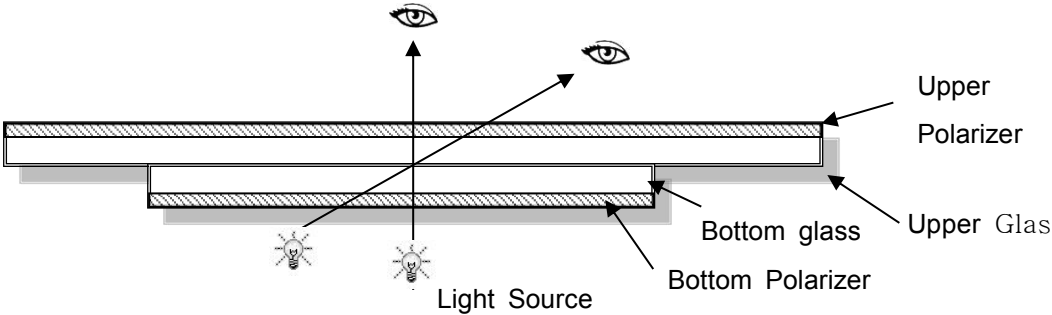
9. Module Out-Going Quality Level

9.1 VISUAL & FUNCTION INSPECTION STANDARD

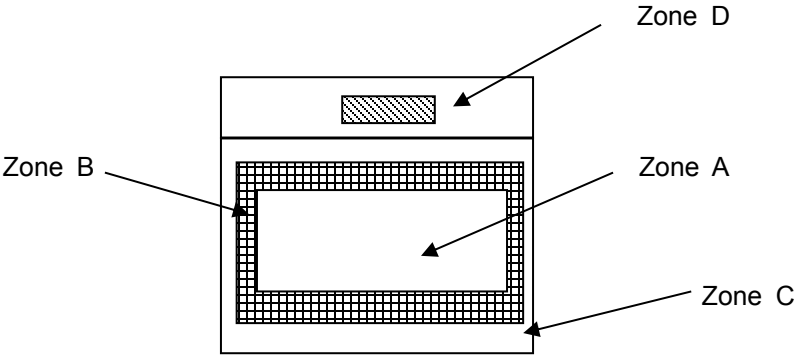
9.1.1 Inspection conditions

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



9.1.2 Definition



- Zone A : Effective Viewing Area(Character or Digit can be seen)
 - Zone B : Viewing Area except Zone A
 - Zone C : Outside (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

9.1.3 Sampling Plan

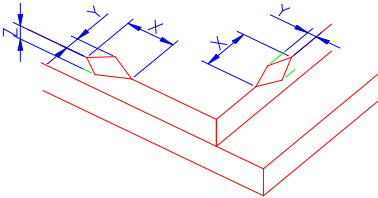
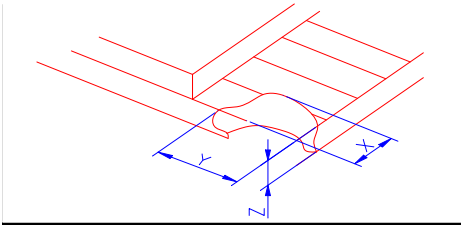
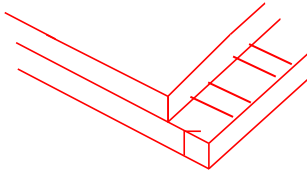
According to GB/T 2828-2012 ; , normal inspection, Class II
AQL:

Major defect	Minor defect
0.65	1.5

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	Module/Polarizer/CG	Black/White spot/line, scratch, crack, etc.	

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

9.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 Module Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of IT O, T: Height of Module	(1) The edge of Module 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)Module 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) Module 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)

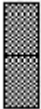
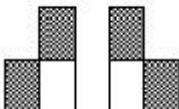
Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore	Ignore	
$0.15 < \Phi \leq 0.25$	3(distance $\geq 10\text{mm}$)		
$0.25 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$)		
$\Phi > 0.4$	0		

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

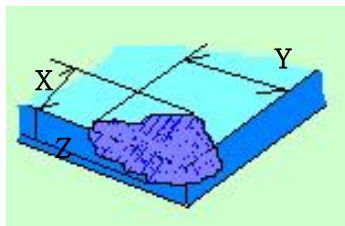
Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		Ignore
$0.2 < \Phi \leq 0.4$	2(distance $\geq 10\text{mm}$)		
$\Phi > 0.4$	0		

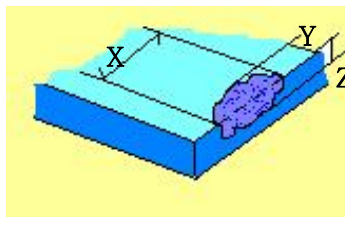
3.0	Module Pixel defect	Pixel bad points <table> <tr> <th>Item</th><th>Zone A</th><th>Acceptable Qt</th></tr> <tr> <td rowspan="3">Bright dot</td><td>Random</td><td>$N \leq 2$</td></tr> <tr> <td>2 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td>3 dots adjacent</td><td>$N \leq 0$</td></tr> <tr> <td 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> </table> Note: A) Bright dot: Dots appear bright and unchanged in size in which Module panel is displaying under black pattern. B) Dark dot: Dots appear dark and unchanged in size in which Module 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 (Module /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																								
$\Phi \leq 0.05$	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	Module Mura/Waving /Hot spot	Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.																										

8.0	CG Related	CG Cover scratch	<table><tr><td rowspan="2">Width(mm)</td><td rowspan="2">Ignore (mm)</td><td colspan="3">Acceptable Qty</td></tr><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>$\Phi \leq 0.05$</td><td>Ignore</td><td colspan="3">Ignore</td></tr><tr><td>$0.05 < W \leq 0.06$</td><td>$L \leq 4.0$</td><td colspan="3">$N \leq 3$</td></tr><tr><td>$0.06 < W \leq 0.08$</td><td>$L \leq 3.0$</td><td colspan="3">$N \leq 2$</td></tr><tr><td>$0.08 < W$</td><td colspan="4">Define as spot defect</td></tr></table>	Width(mm)	Ignore (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.05$	Ignore	Ignore			$0.05 < W \leq 0.06$	$L \leq 4.0$	$N \leq 3$			$0.06 < W \leq 0.08$	$L \leq 3.0$	$N \leq 2$			$0.08 < W$	Define as spot defect				
			Width(mm)			Ignore (mm)	Acceptable Qty																									
				A	B		C																									
			$\Phi \leq 0.05$	Ignore	Ignore																											
			$0.05 < W \leq 0.06$	$L \leq 4.0$	$N \leq 3$																											
			$0.06 < W \leq 0.08$	$L \leq 3.0$	$N \leq 2$																											
		$0.08 < W$	Define as spot defect																													
		CG Cover Pinhole/ La ck of ink	<table><tr><td rowspan="6"> Zone Size (mm) </td><td colspan="3">Acceptable Qty</td></tr><tr><td colspan="3">C</td></tr><tr><td colspan="3">Ignore</td></tr><tr><td colspan="3">4(distance $\geq 10\text{mm}$)</td></tr><tr><td colspan="3">2(distance $\geq 10\text{mm}$)</td></tr><tr><td colspan="3">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			C			Ignore			4(distance $\geq 10\text{mm}$)			2(distance $\geq 10\text{mm}$)			0												
			Zone Size (mm)		Acceptable Qty																											
					C																											
	Ignore																															
4(distance $\geq 10\text{mm}$)																																
2(distance $\geq 10\text{mm}$)																																
0																																

		CG Bonding bubble/ accidented spot <table><tr><th rowspan="2">Size Φ(mm)</th><th colspan="2">Acceptable Qty</th></tr><tr><th>A</th><th>B</th></tr><tr><td>$\Phi \leq 0.1$</td><td colspan="2">Ignore</td></tr><tr><td>$0.1 < \Phi \leq 0.2$</td><td colspan="2">3(distance ≥ 10mm)</td></tr><tr><td>$0.2 < \Phi \leq 0.3$</td><td colspan="2">2(distance ≥ 10mm)</td></tr><tr><td>$\Phi > 0.3$</td><td colspan="2">0</td></tr></table>	Size Φ (mm)	Acceptable Qty		A	B	$\Phi \leq 0.1$	Ignore		$0.1 < \Phi \leq 0.2$	3(distance ≥ 10 mm)		$0.2 < \Phi \leq 0.3$	2(distance ≥ 10 mm)		$\Phi > 0.3$	0	
Size Φ (mm)	Acceptable Qty																		
	A	B																	
$\Phi \leq 0.1$	Ignore																		
$0.1 < \Phi \leq 0.2$	3(distance ≥ 10 mm)																		
$0.2 < \Phi \leq 0.3$	2(distance ≥ 10 mm)																		
$\Phi > 0.3$	0																		
	Assembly deflection	beyond the edge of backlight ≤ 0.2 mm																	
	CG cover broken X : length Y : width Z : height *	<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>$X \leq 0.5$mm</td><td>$Y \leq 0.5$mm</td><td>$Z < \text{cover thickness}$</td></tr></table> Circuitry broken is not allowed.	X	Y	Z	$X \leq 0.5$ mm	$Y \leq 0.5$ mm	$Z < \text{cover thickness}$											
X	Y	Z																	
$X \leq 0.5$ mm	$Y \leq 0.5$ mm	$Z < \text{cover thickness}$																	
	CG cover broken X : length Y : width Z : height *	<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>$X \leq 0.3$mm</td><td>$Y \leq 0.3$mm</td><td>$Z < \text{cover thickness}$</td></tr></table> Circuitry broken is not allowed.	X	Y	Z	$X \leq 0.3$ mm	$Y \leq 0.3$ mm	$Z < \text{cover thickness}$											
X	Y	Z																	
$X \leq 0.3$ mm	$Y \leq 0.3$ mm	$Z < \text{cover thickness}$																	





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	CG no function	Not allowed

10. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	70℃,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the Module; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-20℃, 96HR	
High Temperature Storage	80℃, 96HR	
Low Temperature Storage	-40℃, 96HR	
High Temperature & High Humidity Storage	+60℃, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-10℃,30 min ↔ 60℃,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; (Environment: 15℃~35℃, 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 > 10M Ω) 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.

11. Cautions and Handling Precautions

11.1 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

11.2 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 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-145OLEDN003-C003A	REV	V1.0	Page 31 of 32
----------	----------------------	-----	------	---------------

12. Packing

----TBD-----