



LCD210-101CTL1ARNTR1.0

10.1" HBWG w/PCAP 1200 x 1920

111 Corning Road, Suite 116 • Cary, NC 27518

Approvals	
Model Numbers	LCD210-101CTL1ARNTT
Datasheet Revision	1.3
Drawing Revision	F

Customer Approval	
Approved by: _____	Date: _____

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## Revision History

### Document Revision History

Date	Version #	Description	Created By	Checked By	Approved By
2/1/23	0.1	Preliminary Release	MA	AJ	JH
2/8/23	0.2	Updated mechanical drawing to revision D	DA	AJ	JH
6/28/23	1.0	Production release, added initialization code	DA	AJ	JH
6/29/23	1.1	Corrected surface coating callout in general specifications table	DA	AJ	JH
6/29/23	1.2	Updated backlight specifications added luminance versus power curve.	RS	RT	JH
2/6/2024	1.3	Corrected storage and operating temperature range limits in general specifications table	ZA	RT	JH

### Hardware Revision

Date	Version #	Description
2/1/23	R0.1	Preliminary Release
6/28/23	R1.0	Production Release

## General Specification

Item	Specification	Unit
Outline Dimensions	153.25(H) x 230.93(V) x 7.25(D)	mm
Display Size (Diagonal)	10.1"	inch
Active Area	135.36(H) x 216.58(V)	mm
Sub Pixel Size	37.6 x 112.8	um
Number of Dots	1200 (RGB) x 1920	-
LCD Type	TFT 16.7M	-
Backlight Type	Edge Lit	-
Viewing Direction	All	-
Touch Panel	PCAP GT928	-
Luminance	2000	cd/m2
Interface	MIPI - DSI	-
Storage Temperature	-20 - 70	°C
Operating Temperature	-10 - 60	°C
Surface Coating	AR	-
Driver IC	Himax HX8279-D	-

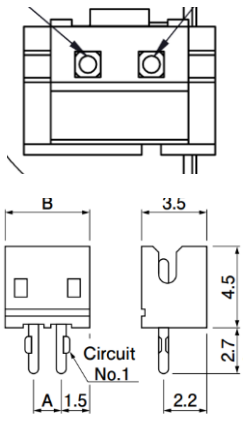
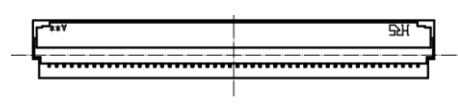
## Pin-Out - LCD

The 10.1" LCD has a Hirose 39 position, 0.3 mm pitch, MPN: FH26W-39S-0.3SHW(60) connector. The connector pin out to LCD210 is shown below.

Number	Symbol	I/O	Description
1	NC	-	Not connected
2	VDDIN (3.3V)	P	Power supply for digital/Analog circuits.
3	VDDIN (3.3V)	P	Power supply for digital/Analog circuits.
4	GND	P	Ground
5	RESET (1.8V)	I	Global reset pin
6	NC	-	Not connected
7	GND	P	Ground
8	MIPI-D0N	I	Negative MIPI differential data input
9	MIPI-D0P	I	Positive MIPI differential data input
10	GND	P	Ground
11	MIPI-D1N	I	Negative MIPI differential data input
12	MIPI-D1P	I	Positive MIPI differential data input
13	GND	P	Ground
14	MIPI_CKN	I	Negative MIPI differential clock input
15	MIPI_CKP	I	Positive MIPI differential clock input
16	GND	P	Ground
17	MIPI-D2N	I	Negative MIPI differential data input
18	MIPI-D2P	I	Positive MIPI differential data input

19	GND	P	Ground
20	MIPI-D3N	I	Negative MIPI differential data input
21	MIPI-D3P	I	Positive MIPI differential data input
22	GND	P	Ground
23	NC	-	Not Connected
24	IOVCC (1.8V)	P	1.8V I/O Supply Voltage
25	GND	P	Ground
26	GND	P	Ground
27	NC	-	Not connected
28	NC	-	Not connected
29	NC	-	Not connected
30	NC	-	Not connected
31	NC	-	Not connected
32	NC	-	Not connected
33	CTP_VDD (3.3V)	O	CTP_VDD for touch I2C bus signals
34	CTP_INT (1.8V)	O	Interrupt for touch I2C bus signals (CTP_IOVCC)
35	CTP_SCL (1.8V)	O	Serial clock line for touch I2C bus signals (CTP_IOVCC)
36	CTP_SDA (1.8V)	O	Serial data for touch I2C bus signals (CTP_IOVCC)
37	CTP_RST (1.8V)	O	Reset for touch I2C bus signals (CTP_IOVCC)
38	CTP_GND	O	Ground for touch I2C bus signals
39	GND	P	GND

## Connectors

Connector Type	MPN	Description
<p><b>S205:</b> 2 POSITION Power Connector</p> 	ZHR-2	For backlight connections. 2-pin, 1.5mm pitch JST connector.
<p><b>S230:</b> 39 POSITION LCD Connector</p> 	FH26W-39S-0.3SHW(60)	Hirose, 0.3mm pitch, 39 position connector. Used to connect LCD210 to driving PCB



## Absolute Max Ratings-LCD

The following are maximum values – exceeding these values may cause faulty operation or damage to the unit.

Item	Symbol	Value		Unit
		Min	Max	
Power Supply Voltage	VDDIN	-0.3	3.6	V
Power Supply Voltage	IOVCC	-0.3	2.1	V
Operating Temperature	T <sub>OPR</sub>	-10	60	°C
Storage Temperature	T <sub>STG</sub>	-20	70	°C

## Absolute Max Ratings – PCAP

Item	Symbol	Value	Unit
Operating Voltage	CTP_VDD	-0.3 – 3.47	V

## Electrical Characteristics – LCD

Item	Symbol	Min	Typ	Max	Unit	Condition
Power Supply Voltage	VDDIN	2.8	3.3	3.6	V	Ta = 25C
Power Supply Current	I <sub>VDD</sub>	200	250	292	mA	
I/O Supply Voltage	IOVCC	1.7	1.8	2	V	
I/O Supply Current	I <sub>VCC</sub>		1	2	mA	
Input Voltage	V <sub>IH</sub>	0.8 IOVCC	-	IOVCC	V <sub>IH</sub>	IOVCC = 1.8V
	V <sub>IL</sub>	0	-	0.2 IOVCC	V <sub>IL</sub>	

## Electrical Characteristics – PCAP

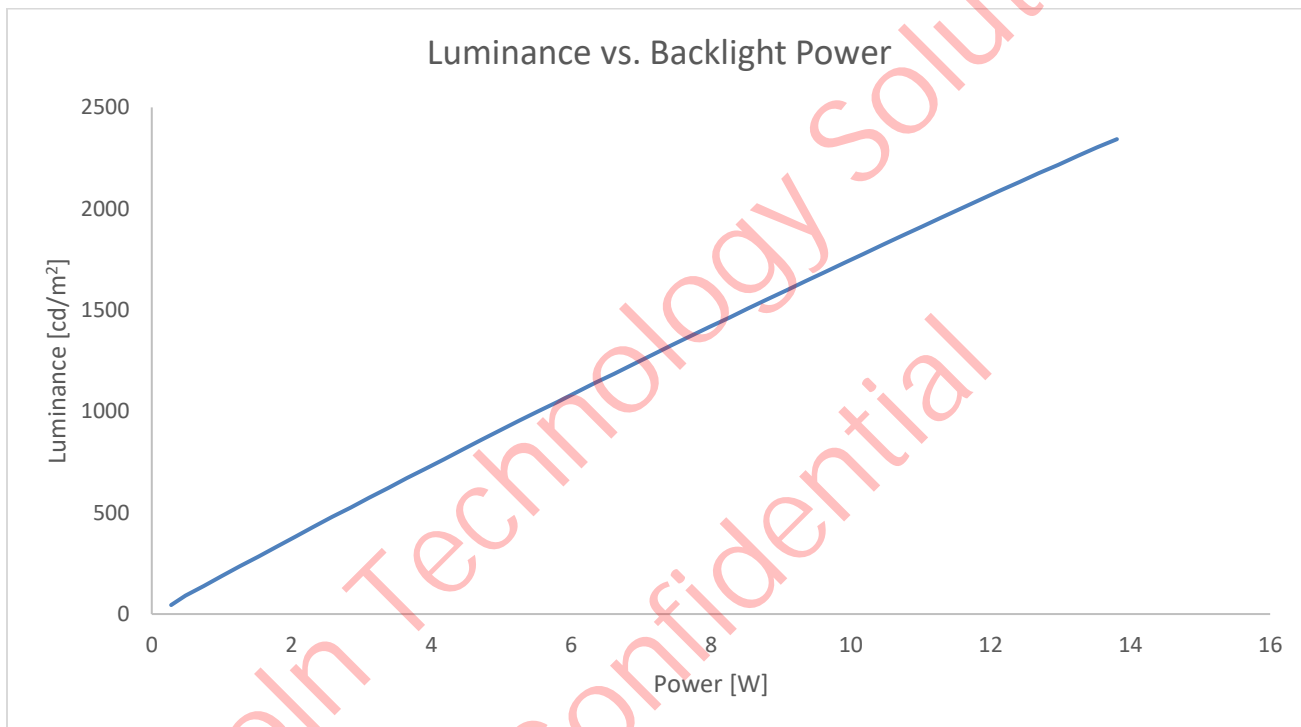
Item	Symbol	Min	Typ	Max	Unit	Test Condition
Power Supply Voltage	CTP_VDD	2.66		3.47	V	-
I/O Supply Voltage	CTP_IOVCC	1.7	1.8	3.47	V	-
Power Supply Current	I <sub>CTP_VDD</sub>	-	13	-	mA	Ta = 25 °C
Input Voltage	V <sub>IH</sub>	1.35	1.8	2.1	V	VDDIO = 1.8V
	V <sub>IL</sub>	-0.3	0	0.45	V	VDDIO = 1.8V
Output Voltage	V <sub>oh</sub>	0.85* CTP_IOVCC	-	-	V	VDDIO = 1.8V
	V <sub>ol</sub>	-	-	0.15* CTP_IOVCC	V	VDDIO = 1.8V

## Backlight Specifications

The design has two LED rails to achieve maximum brightness. JST ZH series connectors were chosen for ease of integration. The backlight wiring has been pinned out to a 2 position, 1.5 mm pitch connector with part number ZHR-2. An example mating connector part number is S2B-ZR-SM2-TF. The supply current mentioned below is the sum, i.e., 215 mA per backlight connector is required for a total of 430 mA (typical) at 2000 NITS.

Item	Symbol	Min	Typ	Max	Unit	Condition
Supply Voltage	$V_f^1$	26.5	27.1	28	V	-
Supply Current	$I_f$	-	430	-	mA	2000 Nits White Screen

Note 1:  $V_f$  is the value of the voltage on LEDA minus the voltage on LEDK.



### Backlight - ZHR-2 pin-out

Number	Name	I/O	Description
1	LEDA	P	Positive backlight power
2	LEDK	P	Negative backlight power

## Timing Specifications -LCD

Please refer to driver IC (Himax HX8279-D) datasheet.

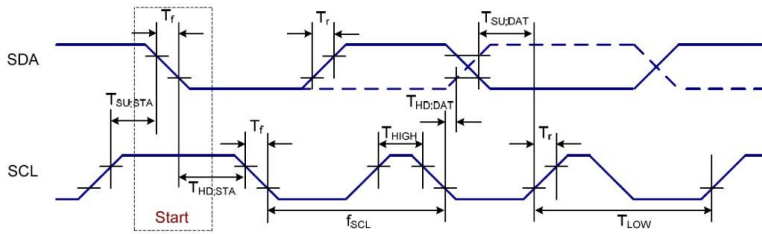
### Initial Code

```
Generic_Short_write_1P(0xB0,0x01);
Generic_Short_write_1P(0xC3,0x0F);
Generic_Short_write_1P(0xC4,0x00);
Generic_Short_write_1P(0xC5,0x00);
Generic_Short_write_1P(0xC6,0x00);
Generic_Short_write_1P(0xC7,0x00);
Generic_Short_write_1P(0xC8,0x0D);
Generic_Short_write_1P(0xC9,0x12);
Generic_Short_write_1P(0xCA,0x11);
Generic_Short_write_1P(0xCD,0x1D);
Generic_Short_write_1P(0xCE,0x1B);
Generic_Short_write_1P(0xCF,0x0B);
Generic_Short_write_1P(0xD0,0x09);
Generic_Short_write_1P(0xD1,0x07);
Generic_Short_write_1P(0xD2,0x05);
Generic_Short_write_1P(0xD3,0x01);
Generic_Short_write_1P(0xD7,0x10);
Generic_Short_write_1P(0xD8,0x00);
Generic_Short_write_1P(0xD9,0x00);
Generic_Short_write_1P(0xDA,0x00);
Generic_Short_write_1P(0xDB,0x00);
Generic_Short_write_1P(0xDC,0x0E);
Generic_Short_write_1P(0xDD,0x12);
Generic_Short_write_1P(0xDE,0x11);
Generic_Short_write_1P(0xE1,0x1E);
Generic_Short_write_1P(0xE2,0x1C);
Generic_Short_write_1P(0xE3,0x0C);
Generic_Short_write_1P(0xE4,0x0A);
Generic_Short_write_1P(0xE5,0x08);
Generic_Short_write_1P(0xE6,0x06);
Generic_Short_write_1P(0xE7,0x02);
Generic_Short_write_1P(0xB0,0x03);
Generic_Short_write_1P(0xBE,0x03);
Generic_Short_write_1P(0xCC,0x44);
Generic_Short_write_1P(0xC8,0x07);
Generic_Short_write_1P(0xC9,0x05);
Generic_Short_write_1P(0xCA,0x42);
Generic_Short_write_1P(0xCD,0x3E);
Generic_Short_write_1P(0xCF,0x60);
Generic_Short_write_1P(0xD2,0x04);
Generic_Short_write_1P(0xD3,0x04);
Generic_Short_write_1P(0xD4,0x01);
Generic_Short_write_1P(0xD5,0x00);
Generic_Short_write_1P(0xD6,0x03);
Generic_Short_write_1P(0xD7,0x04);
Generic_Short_write_1P(0xD9,0x01);
Generic_Short_write_1P(0xDB,0x01);
Generic_Short_write_1P(0xE4,0xF0);
Generic_Short_write_1P(0xE5,0x0A);
Generic_Short_write_1P(0xB0,0x00);
Generic_Short_write_1P(0xBA,0x8F);
Generic_Short_write_1P(0xBD,0x63);
```

```
Generic_Short_Write_1P(0xC2,0x0C);
Generic_Short_Write_1P(0xC4,0x0C);
Generic_Short_Write_1P(0xB0,0x02);
Generic_Short_Write_1P(0xC0,0x00);
Generic_Short_Write_1P(0xC1,0x0A);
Generic_Short_Write_1P(0xC2,0x20);
Generic_Short_Write_1P(0xC3,0x24);
Generic_Short_Write_1P(0xC4,0x23);
Generic_Short_Write_1P(0xC5,0x29);
Generic_Short_Write_1P(0xC6,0x23);
Generic_Short_Write_1P(0xC7,0x1C);
Generic_Short_Write_1P(0xC8,0x19);
Generic_Short_Write_1P(0xC9,0x17);
Generic_Short_Write_1P(0xCA,0x17);
Generic_Short_Write_1P(0xCB,0x18);
Generic_Short_Write_1P(0xCC,0x1A);
Generic_Short_Write_1P(0xCD,0x1E);
Generic_Short_Write_1P(0xCE,0x20);
Generic_Short_Write_1P(0xCF,0x23);
Generic_Short_Write_1P(0xD0,0x07);
Generic_Short_Write_1P(0xD1,0x00);
Generic_Short_Write_1P(0xD2,0x00);
Generic_Short_Write_1P(0xD3,0x0A);
Generic_Short_Write_1P(0xD4,0x13);
Generic_Short_Write_1P(0xD5,0x1C);
Generic_Short_Write_1P(0xD6,0x1A);
Generic_Short_Write_1P(0xD7,0x13);
Generic_Short_Write_1P(0xD8,0x17);
Generic_Short_Write_1P(0xD9,0x1C);
Generic_Short_Write_1P(0xDA,0x19);
Generic_Short_Write_1P(0xDB,0x17);
Generic_Short_Write_1P(0xDC,0x17);
Generic_Short_Write_1P(0xDD,0x18);
Generic_Short_Write_1P(0xDE,0x1A);
Generic_Short_Write_1P(0xDF,0x1E);
Generic_Short_Write_1P(0xE0,0x20);
Generic_Short_Write_1P(0xE1,0x23);
Generic_Short_Write_1P(0xE2,0x07);
    DCS_Short_Write_NP(0x11);
    Delay (800); //milliseconds
    DCS_Short_Write_NP(0x29);
    Delay (40); //milliseconds
```

## Timing Specifications – PCAP

Please refer to Goodix GT928 datasheet. Standardized timings provided for reference.



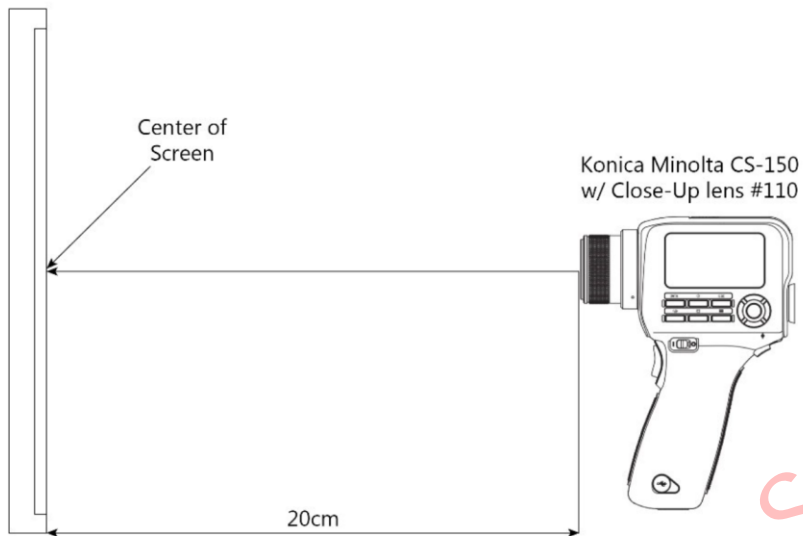
Symbol	Parameter	Min	Typ	Max	Unit
$f_{SCL}$	SCL clock frequency	50	100	400	kHz
$T_{LOW}$	SCL clock LOW period	1.3	-	-	us
$T_{HIGH}$	SCL clock HIGH period	0.6	-	-	us
$T_{SU;DATA}$	Data set-up time	100	-	-	ns
$T_{HD;DATA}$	Data hold time	0	-	0.9	us
$T_r$	SCL and SDA rise time	20	-	300	ns
$T_f$	SCL and SDA fall time	20	-	300	ns
$T_f$	SDA fall time for read out	20	-	1000	ns
$C_b$	Capacitive load represented by each bus line	-	-	400	pF
$T_{SU;STA}$	Setup time for a repeated START condition	0.6	-	-	us
$T_{HD;STA}$	START condition hold time	0.6	-	-	us
$T_{SU;STO}$	Setup time for STOP condition	0.6	-	-	us
$T_{SW}$	Tolerable spike width on bus	-	-	50	ns
$T_{BUF}$	Bus free time between a STOP and START condition	4.7	-	-	us

## Optical Characteristics

Item		Symbol	Conditions	Specifications			Unit	Note	
				Min.	Typ.	Max.			
Contrast Ratio		CR		876.6	936	1011.9	--	(1)(3)(5)	
Response Time		Ton + Toff	Ta= 25 °C		25		ms	(1)(4)	
Viewing Angle	Hor.	X-	Ta= 25 °C	80	85		Deg.	(3)(5)	
		X+		80	85				
	Ver.	Y+		80	85				
		Y-		80	85				
Chromaticity	Red	Rx		0.673	0.67325		0.674	--	
		Ry		0.321	0.321		0.321	--	
	Green	Gx		0.203	0.2055		0.208	--	
		Gy		0.685	0.6884		0.692	--	
	Blue	Bx	0.148	0.1488	0.149	--			
		By	0.051	0.05325	0.054	--			
	White	Wx	0.297	0.3	0.304	--			
		Wy	0.324	0.3303	0.338	--			
Color Gamut Coverage DCI-P3				91.92	92.38	92.99	%		
DCI-P3 Ratio				104	105	105	%		
Uniformity	U			85.59	88.2	91.97	%		
Luminance	L	Ta= 25 °C		-	2000	-	cd/m2	(1)	

**Note (1) Definition of Measurement Setup:**

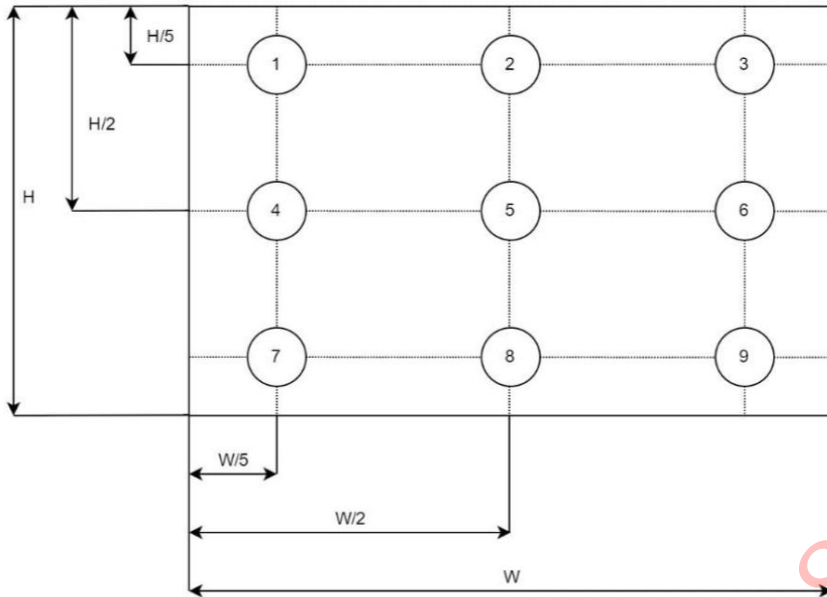
The LCD module should be stabilized at a given temperature for 25 minutes to avoid abrupt temperature change during measurement. After temperature saturation should be executed.



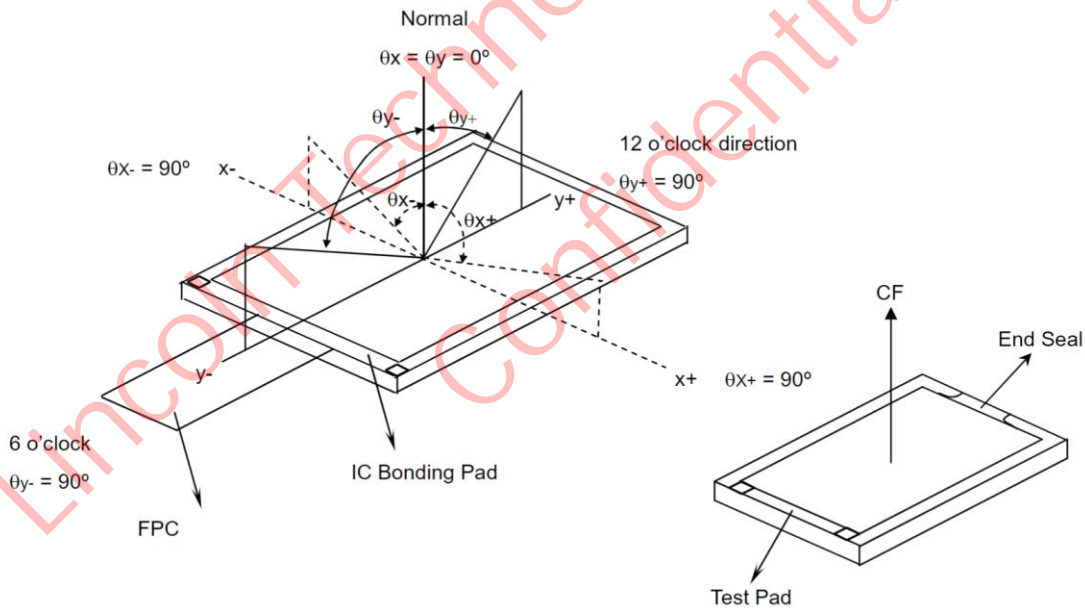


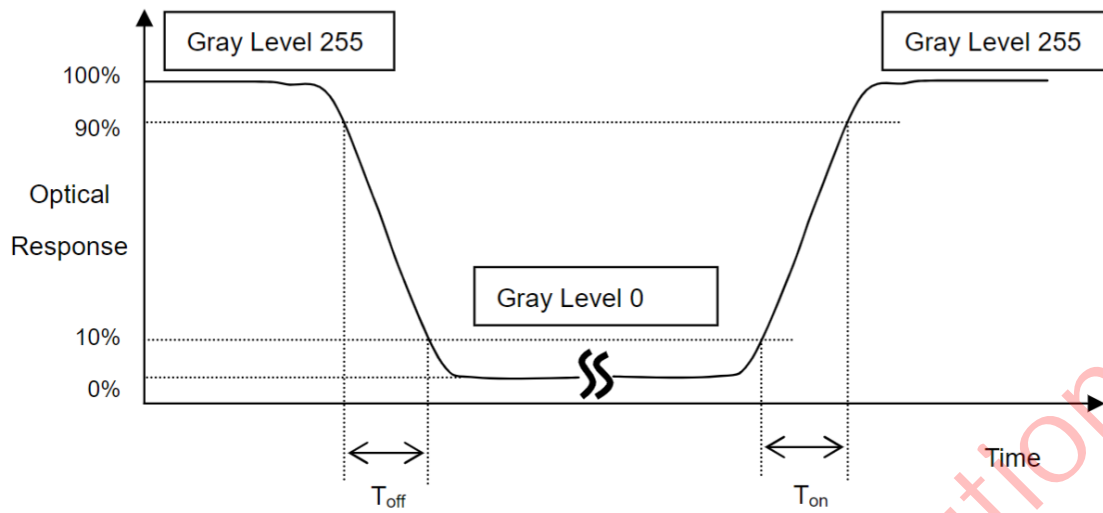
**Note (2) Definition of Brightness Uniformity**

$$\text{Brightness Uniformity} = \frac{\text{Minimum Luminance of 9 points}}{\text{Max Luminance of 9 points}} * 100$$



**Note (3) Definition of Viewing Angle**

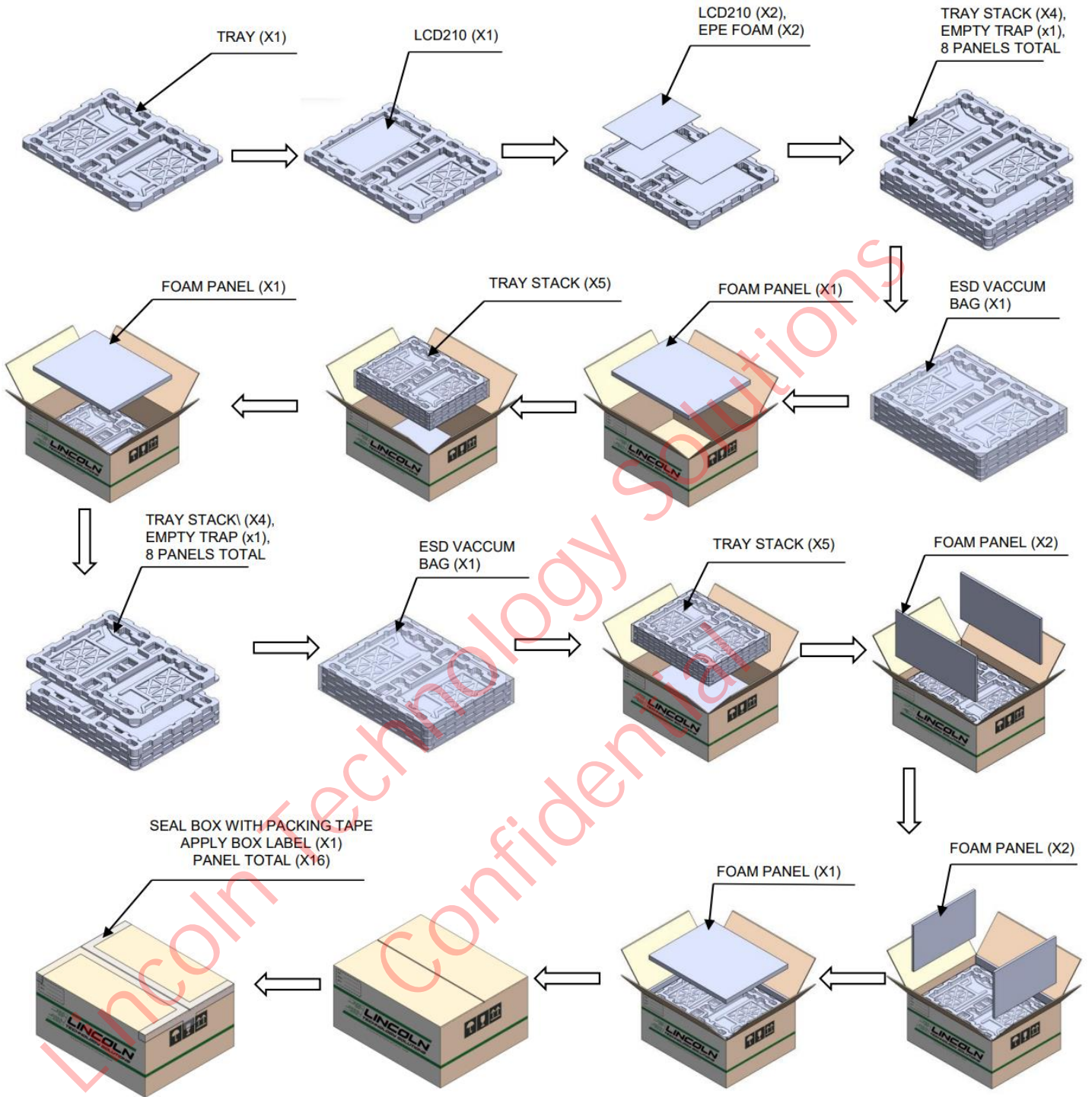


**Note (4) Definition of Response Time ( $T_{on}$ ,  $T_{off}$ ):****Note (5) Definition of Contrast Ratio:**

Contrast measurements shall be made at a viewing angle of  $0^\circ$  at the center of the surface

$$CR = \frac{\text{Luminance when displaying White}}{\text{Luminance when displaying Black}}$$

# Packaging

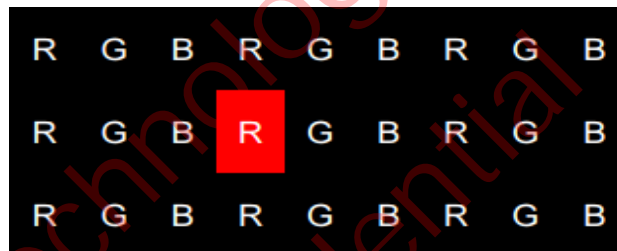
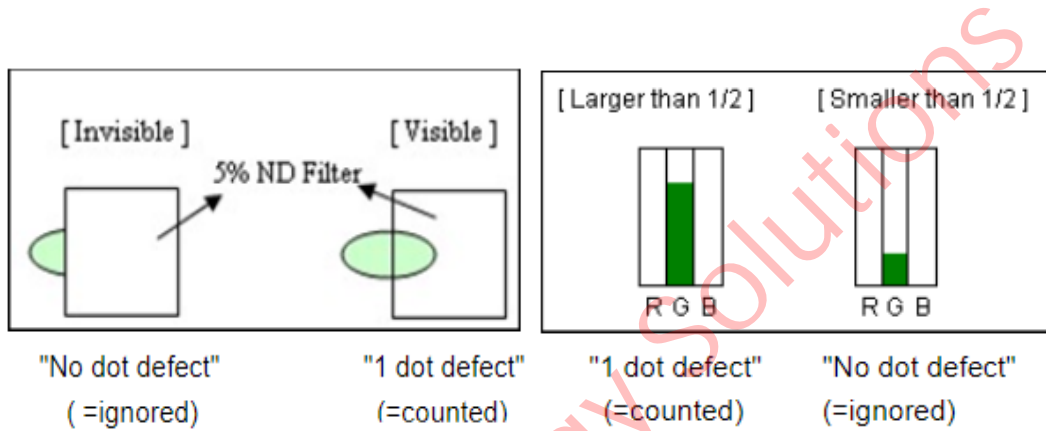


## Quality & Inspection Criteria

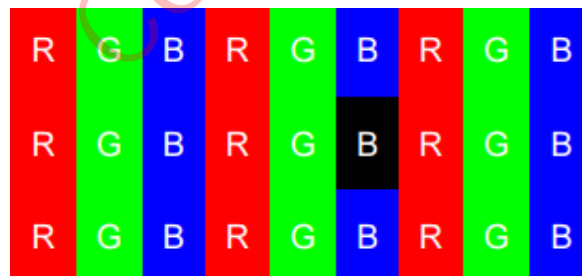
### Terminologies:

**LCD:** Liquid Crystal Display; Each pixel contains three dots of R, G, and B (sub-pixel).

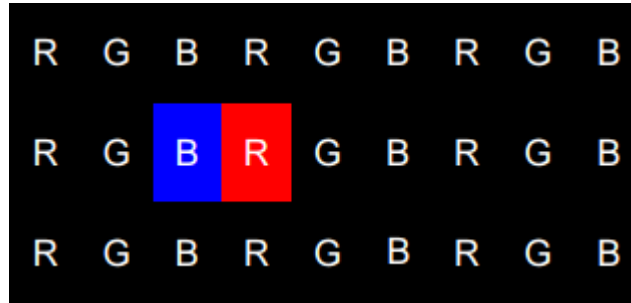
**Bright Dot:** 1 sub-pixel is a dot. Defects should be larger than 1/2 of a sub-pixel. Dots that are not visible through a 5% ND filter or smaller than 1/2 of sub-pixel size will not be counted as a dot defect.



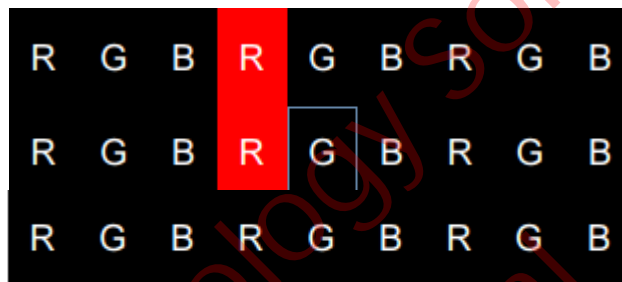
**Dark Dot:** Any single sub-pixel that does not light up on a white screen or another non-black screen is called a dark dot.



**Two adjacent dots (horizontal direction):** Use the bright dot illustration as an example to demonstrate two horizontal consecutive dots.

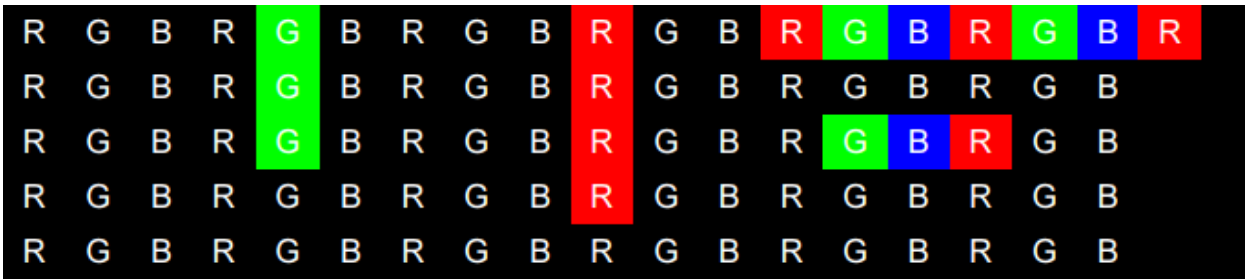


**Two adjacent dots (vertical direction):** Use the bright spot illustration as an example to demonstrate two vertical consecutive dots.



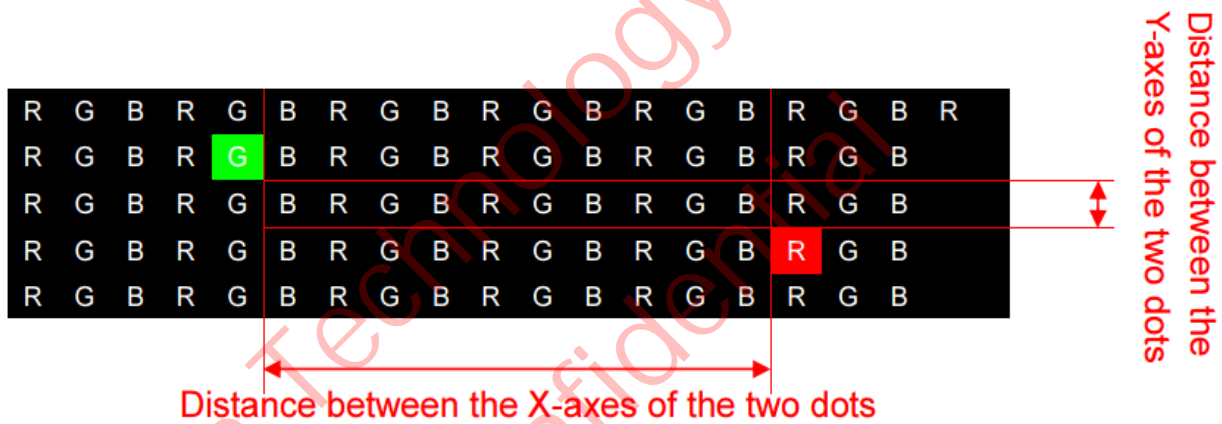
**Two adjacent dots (bevel direction):** Use the bright spot illustration as an example to demonstrate two consecutive dots in the bevel direction





**Three or more adjacent dots (horizontal):** Use the bright spot illustration as an example to demonstrate three or more consecutive horizontal and vertical dots.

**Illustration of spacing between two dots:** (Distance is the relative distance between the X-axes of the two dots or the relative distance between the Y-axes of the two dots, whichever is larger)



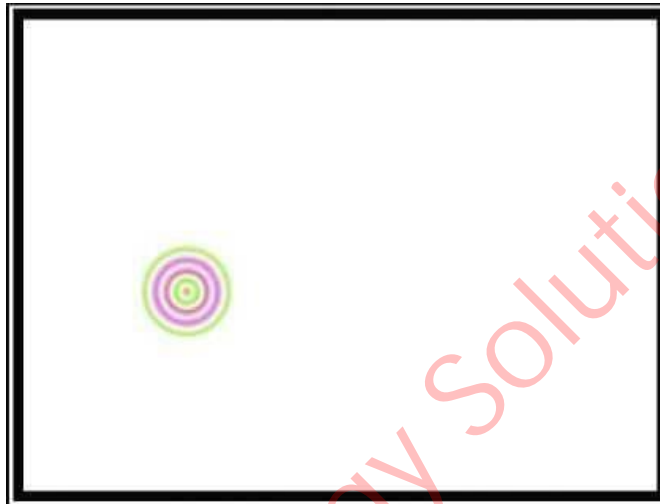
**Functional Test**

The LCD testing program should display the following screens in order: all red, all green, all blue, all white, all gray, and all black.

## Inspection Requirements

After booting the system (single illumination), there are no non-display, unlit backlight, dark backlight, blinking, or other abnormal signs, and there are no bright lines, dark lines, or bright rims/leakage of light close to the LCD bezel.

## Newton's Ring



Under high temperature and high humidity conditions, uneven deformations caused by heat in different layers of the LCD module will display an all-white screen. However, this condition can be recovered when the temperature is resumed under normal circumstances. A specific determination can be conducted according to the operating conditions and storage conditions defined in the product's technical specifications. Any exception will be negotiated and mutually agreed upon by both parties. (Ripples are not permitted at fixed locations. Ripples at non-fixed locations are OK if they disappear within two seconds.)

**LCD blaze**

Uneven internal LCD installation, surface deformation of the LCD polarizer, internal structural interference of the LCD module, damaged LCD backlight plates, and other factors may cause partial fading of color on the LCD. When observed from a certain incident angle (upper 10°, lower 3°, 40° on both sides), they will appear as white cicatrices, typically about the size of a grain of rice. In serious cases, they accumulate in large patches or stripes, appear in different degrees under various colors (red, blue, green, black, gray, white), and are especially obvious under an all-gray screen. Blazes with diameters  $\geq 0.5\text{mm}$  are not allowed: for those with diameters under 0.5 mm, 2 are acceptable if the space between them is  $\geq 15\text{mm}$ . Card chromatic aberration ratio versus ND Filter:  $1.0 + 0.3 \text{ standard} = 5\% \text{ ND Filer}$  (see definition of Mura).

**Mura**

Mura refers to the unevenness and irregularity that is visible in the image. It is difficult for visual inspection to recognize the non-uniform brightness or mura. Mura detection is subjective and therefore doesn't have pass/fail criteria. There are several precautions to take which can avoid mura. Avoid high ambient temperatures around the module, frame warpage, and high-temperature operation over long periods of time. Utilize screen savers to avoid mura.



## Inspection Conditions

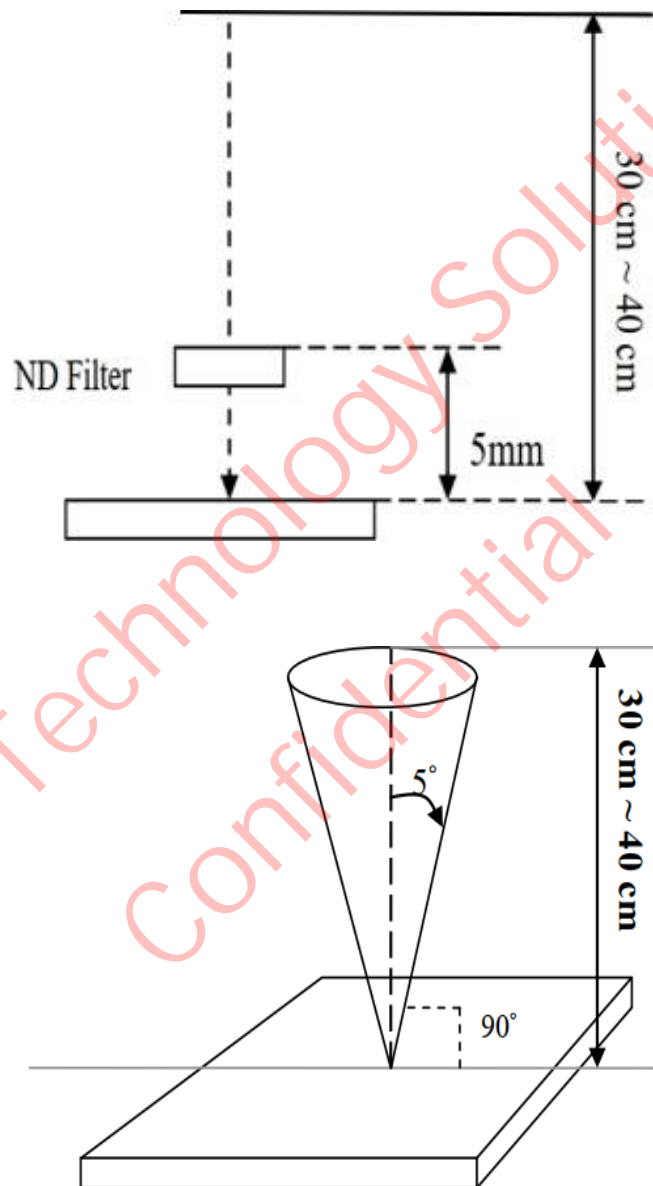
The inspection distance should be  $35\text{cm} \pm 5\text{cm}$  with a FujiFilm ND-LCD 5% filter approximately 5cm from the backlight surface.

Viewing angle:  $90^\circ \pm 5^\circ$ .

Room temperature:  $23 \pm 2^\circ\text{C}$

Humidity:  $60 \pm 10\%$

Inspection Ambient Illumination: 300-700 LUX



## Acceptance Criteria Table

There should be no corrosion or cracking, or an uneven coating layer on the LCD surface, and there should be no sign of coagulation, flaking, cracking, or wear. The definition of minor defects and acceptance criteria are shown in the following table:

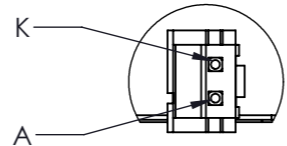
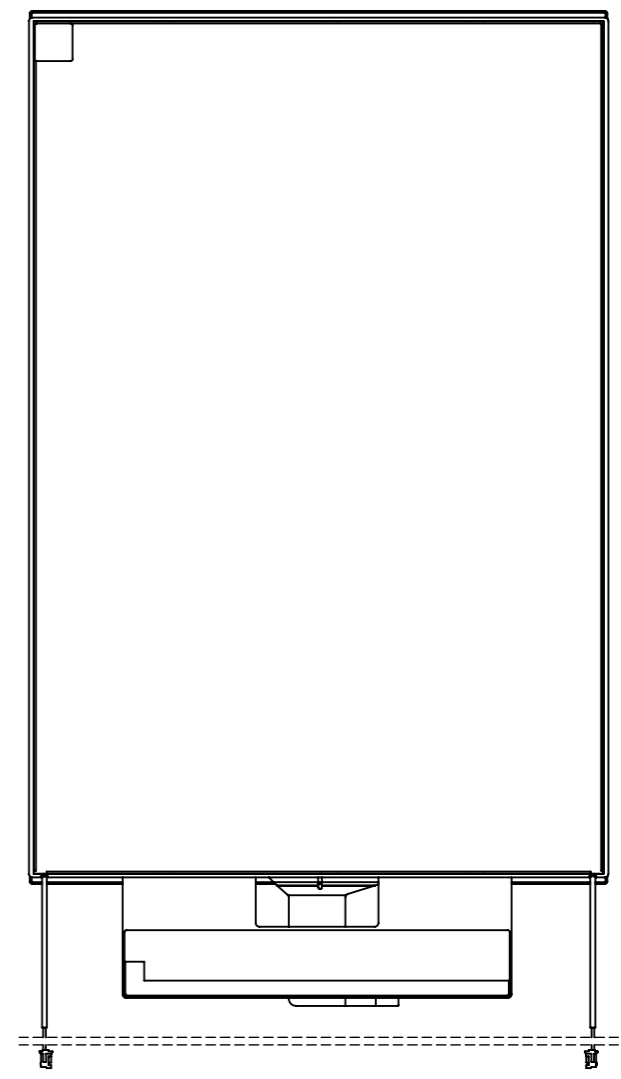
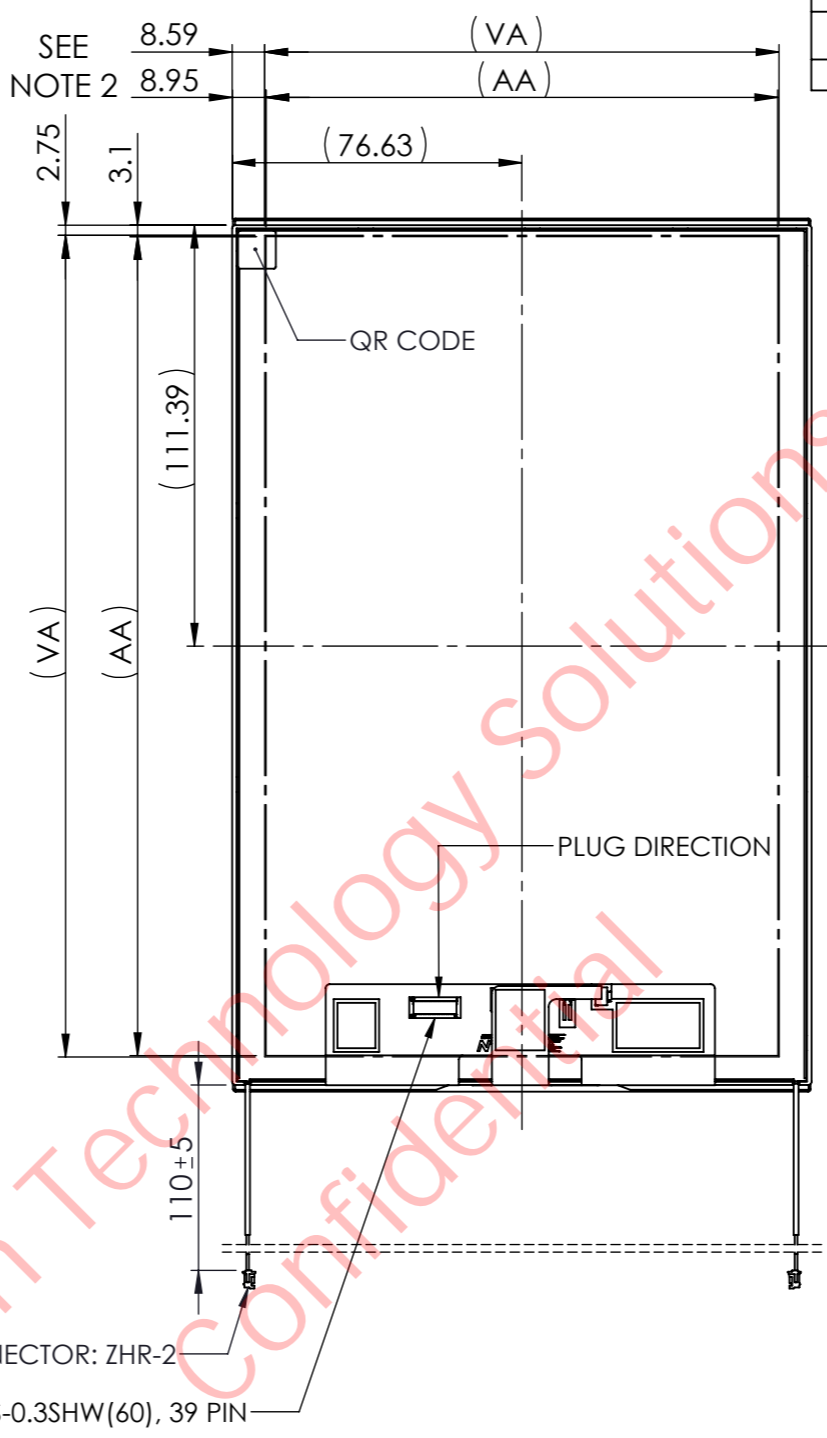
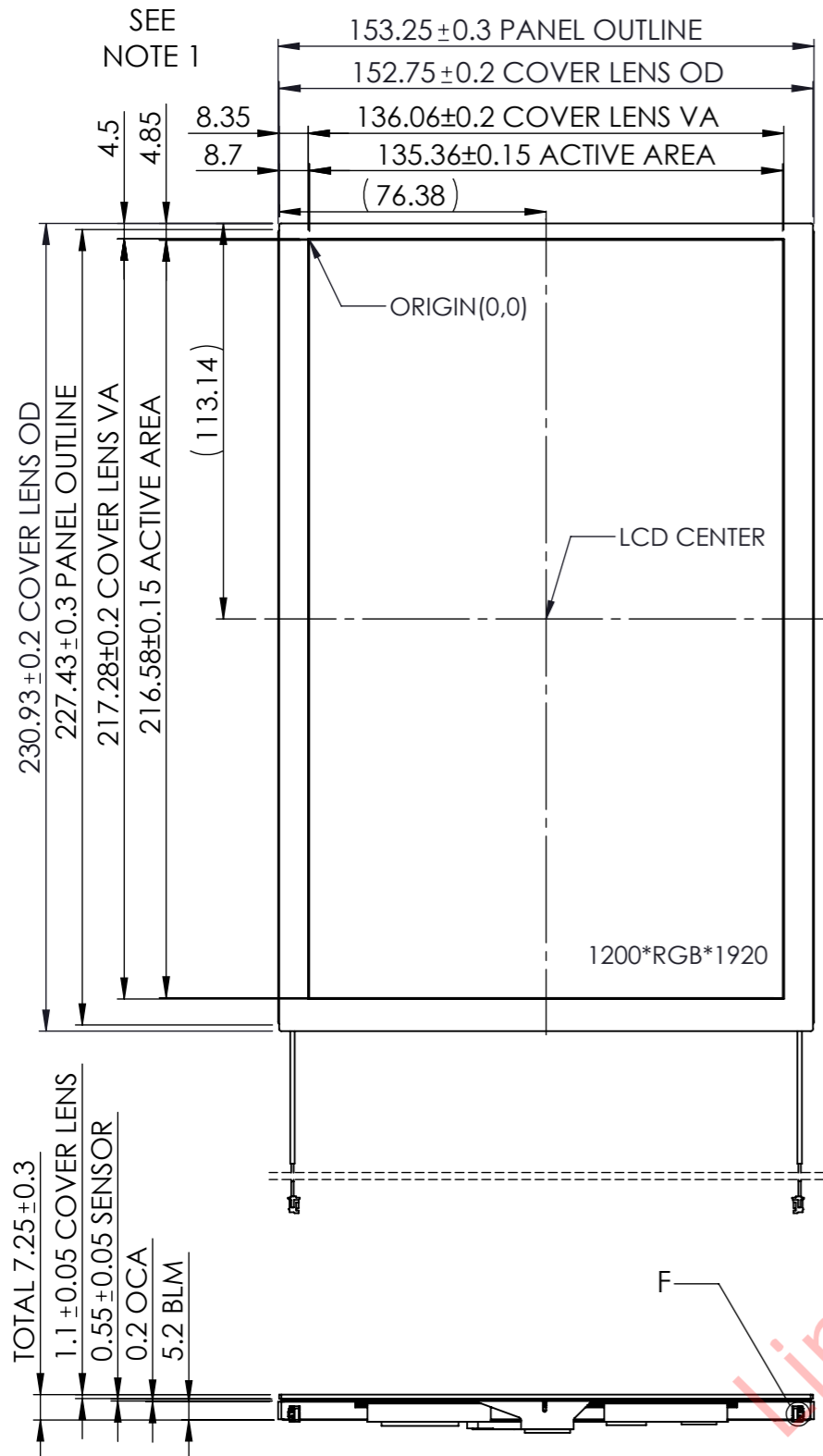
Item	Size	Unit	Acceptance qty.
Unfelt scratch visible with backlight off.	$W < 0.05$	mm	Ignore
	$W > 0.05$ and $< 0.10$ $L > 0.3$ and $< 3.0$	mm	4
	$W > 0.10$ or $L > 3.0$	mm	none
	Visible with backlight on		none
Felt scratch	None allowed		
Dent visible with backlight off	$D < 0.2$	mm	Ignore
	$D > 0.2$ and $< 0.5$	mm	5
	Spacing between defects must be $> 30\text{mm}$		
	$D > 0.5$	mm	none
Visible with backlight on		none	
Bubble visible with backlight off	$D < 0.2$	mm	Ignore
	$D > 0.2$ and $< 0.5$	mm	5
	$D > 0.5$	mm	none
	Visible with backlight on		none

Item	Size	Unit	Acceptance qty.
Foreign material (line shape) visible with backlight on	W < 0.05	mm	Ignore
	W > 0.05 and < 0.10 L > 0.3 and < 2.0	mm	4
	W > 0.10 or L > 2.0	mm	none
Foreign material (dot shape) visible with backlight on	D < 0.2	mm	Ignore
	D > 0.2 and < 0.5	mm	5
	D > 0.5	mm	none
Bright dot defect(lit)	1 dot	-	4
	2 adjacent dots	-	0
Dark dot defect (not lit)	1 dot	-	5
	2 adjacent dots	-	2
	3 adjacent dots	-	0

## Appendix 1: Mechanical Drawing

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ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	INITIAL ISSUE	12/29/2021	QIN
	B	UPDATED TO LATEST LTS DRAWING FORMAT, CORRECTED PART NUMBER, ADDED GENERAL TOLERANCE TABLE	11/21/2022	JH
	C	REMOVED PINOUT TABLES, ADDED LCD CONNECTOR LABELS	2/1/2023	JH
	D	ADDED VA AND AA DIMENSIONS AND NOTES	2/7/2023	JH
	E	ADDED TOUCH ORIGIN(0,0), VIEWS CHANGED FROM HORIZONTAL TO PORTRAIT	5/5/2023	JH
	F	UPDATED HW REV	5/26/2023	JH



DETAILED VIEW F  
SCALE 3 : 1

NOTES:  
 1. FRONT VIEW VA AND AA DIMENSIONS ARE FROM EDGES OF COVERGLASS  
 2. REAR VIEW VA AND AA DIMENSIONS ARE FROM EDGES OF BACKLIGHT FRAME

GENERAL TOLERANCE TABLE(±MM)	
L ≤ 20	0.1
20 < L ≤ 50	0.2
50 < L ≤ 100	0.25
100 < L ≤ 200	0.3
L > 200	0.5
SCALE: 1:2	SHEET 1 OF 1
DO NOT SCALE DRAWING	

DRAWN BY: LH	DATE 5/26/2023
CHECKED BY: JH	DATE 5/26/2023
MATERIAL: N/A	
FINISH: N/A	
COMMENTS: ALL DIMENSIONS ARE IN MILLIMETERS.	



DESCRIPTION 10.1" LCD HBWG W/PCAP GENERIC		
PART NO. LCD210-101CTL1ARNTT	HW REV. 1.0	DRW REV. F

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