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LCD121-070CTL1ARNTT

7″ WUXGA 360 Zone Wide gamut Full Array Local Dimming

LTS Proprietary FOG with In-Cell Touch with Cover lens

1200*1920

Rev.1.9

Approvals	
Model Number	LCD121-070CTL1ARNTT
Datasheet Revision	R1.9
Drawing Revision	C

Customer	
Approved by: _____	Date: _____

Table of Contents

Revision History

Document Revision

Date	Version #	Description	Created By	Checked By	Approved By
12/19/2019	R1.0	Preliminary Release	--	--	--
1/24/2020	R1.1	Updated tables, temperature revised, inspection environment added, optical parameters changed to TBD	--	--	--
1/27/2020	R1.2	Adding VESA HDR pattern testing tables, updated optical measurements	--	--	--
3/27/2020	R1.3	Correcting Pinout on 40 pin connector. HDR specs removed until new HW is tested.	--	--	--
4/15/2020	R1.4	Correction to 7" pinout.	--	--	--
5/7/2020	R1.5	Removed erroneous electrical table and change reference to LED +/- in 40 pin connector to NC. Supply current +/-5V updated.	--	--	--
7/24/2020	R1.6	Corrected Touch and Contrast Ratio	--	--	--
3/15/2021	R1.7	Update the part number	--	--	--
12/8/2021	R1.8	UPDATED Drawings to reflect current PCB part number	--	--	--
09/26/2022	R1.9	Added Mechanical Drawing R2.0, updated copyright, address, Rev, formatting, and removed rev from title. Updated cd/m2 and I_{VCC_24} under electrical characteristics – Power for Connector A, updated LTS logo to include trademark symbol	ZH	DA	JH

Rev.1.9

Hardware Revision

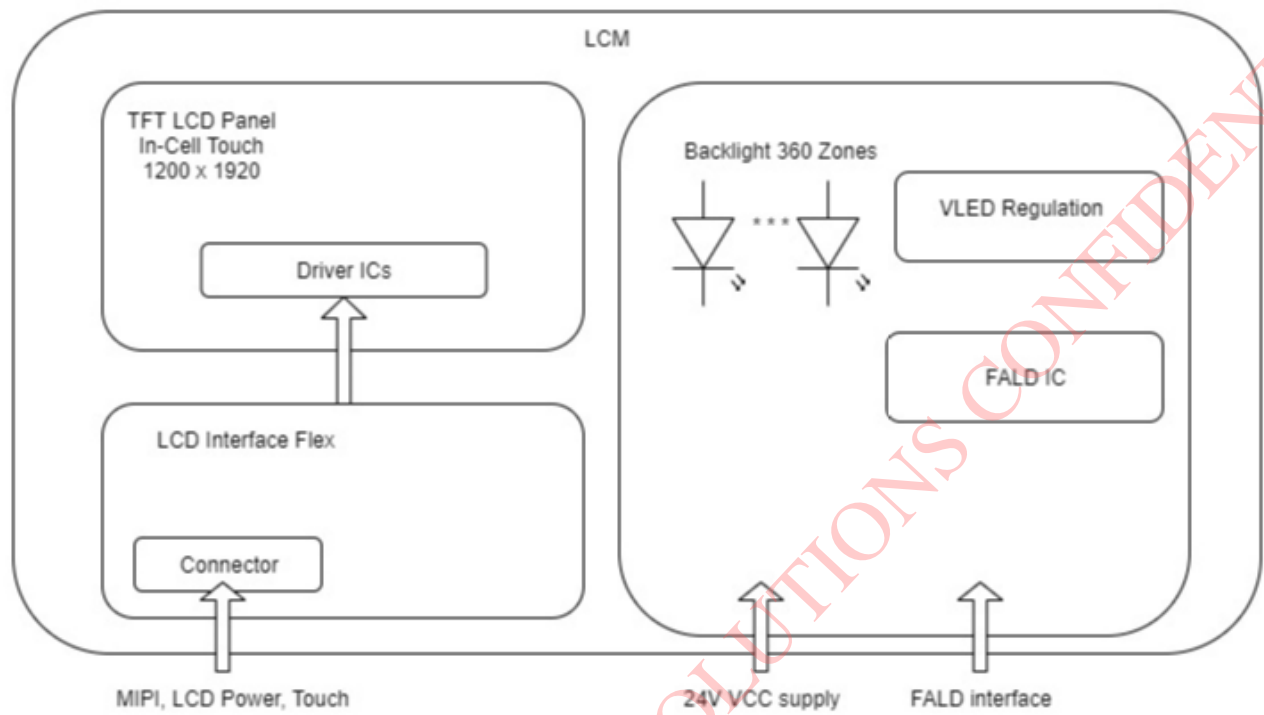| Date	Version #	Description
Jan 2020	R0.1	Prototype sample
May 2020	R0.2	3V3 to 1V8 FALD interface correction
March 2021	R1.0	Production
Dec 2021	R1.2	Production with Corrected Schematic Changes to indicator LEDs and circuit protection.
01/13/2022	R2.0	Updated 40 pin connector width, max PCB component height, added latest PCB revision.

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General Specifications

Item	Specification	Unit
Outline Dimensions	162.92 x 104.00 x 14.99	mm
Display Size	7.02 Diagonal	inches
Active Area	151.20 X 94.50	mm
Pixel Pitch	0.07875 X 0.07875	mm
Number of Dots	1200 X 1920	-
Backlight Type	360 zone full array local dimming	-
Touch Panel	10 Finger Capacitive In-Cell Touch	-
Luminance	1800 - uncalibrated	cd/m^2
Interface	MIPI	-
Color Gamut Ratio DCI-P3	100	%
LCD Type	ADS 10 bit (8bit + 2bit FRC)	-

Absolute Max Ratings

Item	Symbol	Value	Unit
Operating Temperature	T_{opr}	-20 ~ 70	°C
Storage Temperature	T_{stg}	-30 ~ 80	°C

Rev.1.9

Block Diagram

LCM

TFT LCD Panel
In-Cell Touch
1200 x 1920

Driver ICs

LCD Interface Flex

Connector

Backlight 360 Zones

VLED Regulation

FALD IC

MIPI, LCD Power, Touch

24V VCC supply

FALD interface

Rev.1.9

Connector Summary

LCD121 has 3 connectors called out on the following drawing as A, B, and C. Connector A is for power. Connector B is for the FALD interface. And Connector C is for the LCD interface.

Rev.1.9
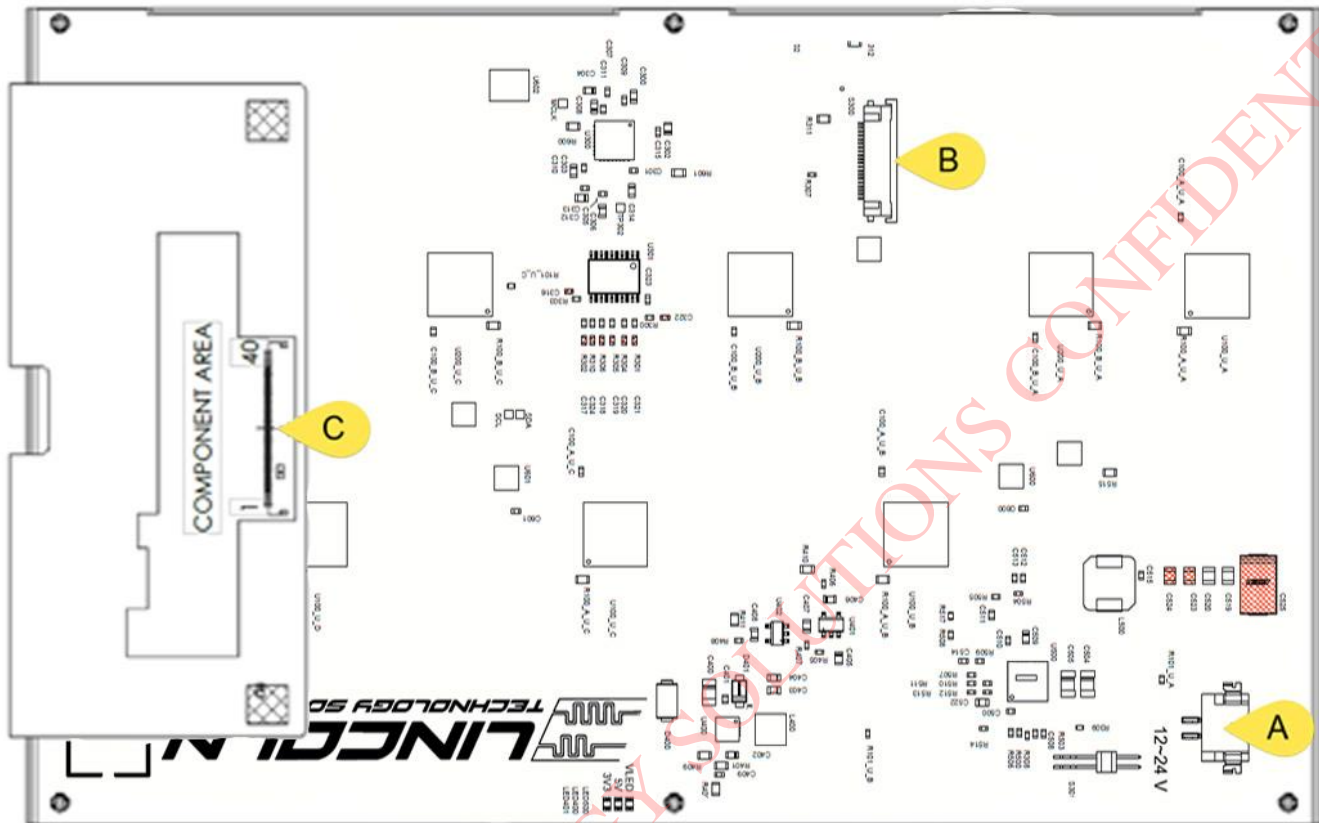
Connector A

Pin Out – Power

The power connector is Hirose DF3EA-2P-2H and it is expecting the incoming wiring harness sized to 22AWG. This is the heaviest gauge wire that can be crimped into the connector and allows for max current of 3A per contact. It will be possible to overdrive the LED array through control over the FALD interface. Care should be taken to not exceed the maximum amperage or board temperature.

Number	Pin Name	I/O	Description
1	VCC_24V	Power	Power input
2	GND	Power	Ground

Absolute Max Ratings – Power

Item	Symbol	Value	Unit
Supply Voltage	VCC_24V	12 ~ 40	V
Supply Current (22AWG)	VCC_24V	3	A
Input Ripple	V_{RIP}	0.5	V

Electrical Characteristics – Power

Note: These current levels represent a typical LED refresh rate with all LEDs configured at 15mA per LED.

These values were obtained by modulating the duty cycle of the LEDs.

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Voltage	VCC_24V	-	24	-	V	
Supply Current Connector A	I_{VCC_24V}	-	0.887	-	A	Minimum Luminance is 0.002 Nits

Luminance vs. Power

Rev.1.9
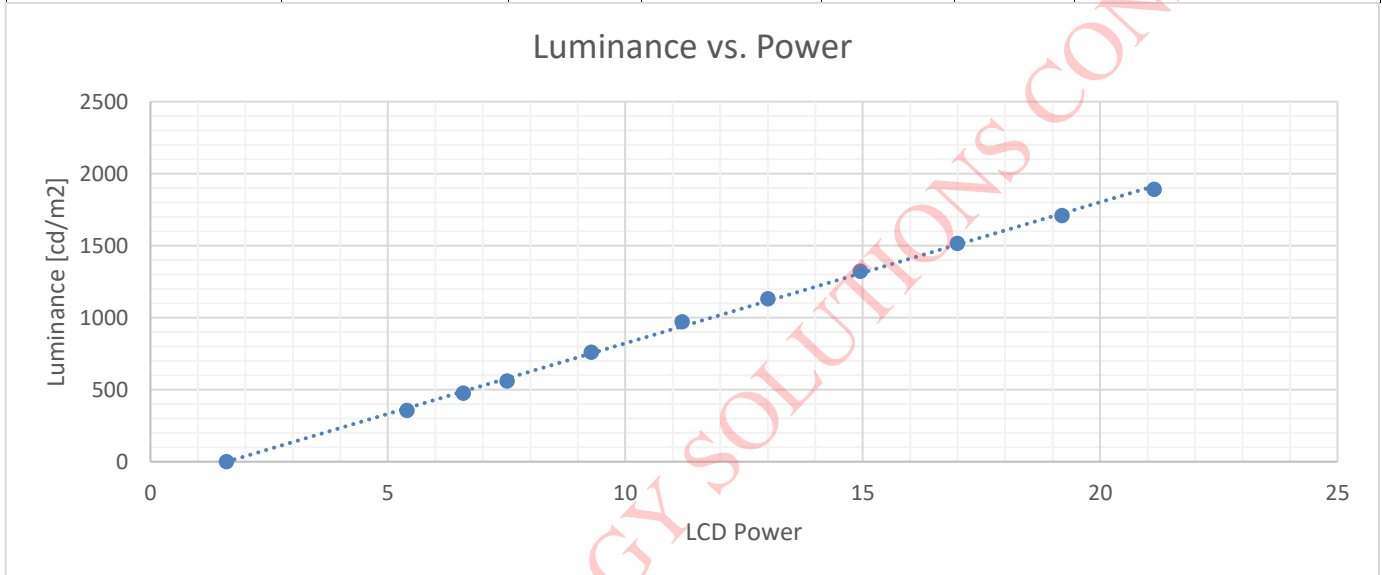
Connector B

Pin Out – FALD

A 20 pin Amphenol SFV20R-2STE1HLF at 0.5mm pitch with top contacts receives the FALD signaling from the host. The power rail on pin 1 is only to be used as a reference level or to power minimal consuming devices such as a level shifter on the host PCB.

Number	Pin Name	VIO	I/O	Description
1	VCC_3V3	N/A	O	Power output
2	GND	N/A	P	Ground
3	TDI	3V3	I	JTAG – Program interface
4	TCK	3V3	I	JTAG – Program interface
5	TMS	3V3	I	JTAG – Program interface
6	TDO	3V3	O	JTAG – Program interface
7	RESETN	3V3	I	FALD Controller reset – externally PU on FALD PCB
8	GND	N/A	P	Ground
9	SPARE_IO_LB_1V8	1V8	I/O	Future use
10	LED_DATA_IN_1V8	1V8	I	FALD backlight data
11	LED_CLK_IN_1V8	1V8	I	FALD backlight clock
12	FALD_EN	1V8	I	Enables FALD operation
13	GND	N/A	P	Ground
14	DNU	N/A	-	Reserved for customer use – not connected on FALD PCB
15	DNU	N/A	-	Reserved for customer use – not connected on FALD PCB
16	DNU	N/A	-	Reserved for customer use – not connected on FALD PCB
17	TEMP_CLK_OUT_1V8	1V8	O	FALD temperature clock
18	TEMP_DATA_OUT_1V8	1V8	O	FALD temperature data
19	DNU	N/A	-	Reserved for customer use – not connected on FALD PCB
20	GND	N/A	P	Ground

Absolute Max Ratings – FALD

Item	Symbol	Value	Unit
Max Load	I_{VCC_3V3}	0.1	A

Electrical Characteristics – FALD

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Operating Voltage 3V3	VCC_3V3	3.1	3.3	3.5	V	-
3V3 Logic Levels	V_{IH3V3}	2.0	3.3	3.6	V	-
	V_{IL3V3}	-0.3	0.0	0.8	V	-
	V_{OH3V3}	2.7	-	3.5	V	$I_{OH} \leq 12mA$
	V_{OL3V3}	0.0	-	0.4	V	$I_{OL} \leq 12mA$
1V8 Logic Levels	V_{IH1V8}	1.24	1.8	3.6	V	-
	V_{IL1V8}	-0.3	0.0	0.6	V	-
	V_{OH1V8}	1.3	-	1.9	V	$I_{OH} \leq 12mA$
	V_{OL1V8}	0.0	-	0.4	V	$I_{OL} \leq 12mA$

Connector C

The LCD connector is a 40 pin ZIF with 0.5mm pitch. It accepts an FFC of 0.3mm thickness and gold-plated contacts. An example of the part mounted on the LCD flex is, Hirose FH28-40S-0.5SH(05)

Pin Out – LCD

Number	Pin Name	I/O	Description
1	NC	-	No connection – Must not connect
2	VLCD	P	LCD Power supply
3	VLCD	P	LCD Power supply
4	GND	P	Ground
5	LCD_RSTN	I	LCD reset signal, Active Low
6	NC	-	No connection
7	GND	P	Ground
8	MIPI_0N	I/O	MIPI Negative data inputs
9	MIPI_0P	I/O	MIPI Positive data inputs
10	GND	P	Power ground
11	MIPI_1N	I	MIPI Negative data inputs
12	MIPI_1P	I	MIPI Positive data inputs
13	GND	P	Power ground
14	MIPI_CKN	I	MIPI Negative clock inputs
15	MIPI_CKP	I	MIPI Positive clock inputs
16	GND	P	Power ground
17	MIPI_2N	I	MIPI Negative data inputs
18	MIPI_2P	I	MIPI Positive data inputs

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Rev.1.9

19	GND	P	Power ground
20	MIPI_3N	I	MIPI Negative data inputs
21	MIPI_3P	I	MIPI Positive data inputs
22	GND	P	Power ground
23	TP_SCL	I	TP I2C Clock
24	TP_SDA	I/O	TP I2C Data
25	GND	P	Power ground
26	LCD_TE	O	Tear output
27	LCD_PWMO	O	PWM control signal for LED driver (CABC)
28	TP_INT	O	Touch Interrupt
29	TP_RST	I	TP reset signal
30	GND	P	Power ground
31	NC	-	No connection
32	NC	-	No connection
33	NC	-	No connection
34	VSN	P	Analog supply negative voltage (-5~-6V)
35	VSN	P	Analog supply negative voltage (-5~-6V)
36	NC	-	No connection
37	VSP	P	Analog supply positive voltage (5~6V)
38	VSP	P	Analog supply positive voltage (5~6V)
39	NC	-	No connection
40	NC	-	No connection

Rev.1.9

Absolute Max Ratings – LCD

Item	Symbol	Value	Unit
Power Supply Voltage	VLCD	-0.3 ~ 4.5	V
Logic Input	VIN	-0.3 ~ VLCD+0.3	V
Power for Analog Negative	VSN	0 ~ -6.6	V
Power for Analog Positive	VSP	0 ~ +6.6	V

Electrical Characteristics – LCD

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Operating Voltage	VLCD	1.65	1.8	3.6	V	-
Voltage for Analog Negative	VSN	-6.5	-5.5	-4.5	V	-
Voltage for Analog Positive	VSP	4.5	5.5	6.5	V	-
Supply Current	I_{VLCD}	-	-	65	mA	Ta = 25 °C
Supply Current	I_{VSN}	-	-	75	mA	Ta = 25 °C
Supply Current	I_{VSP}	-	-	75	mA	Ta = 25 °C
Logic High Input Level	V_{IH}	0.7VLCD	-	VLCD	V	-
Logic Low Input Level	V_{IL}	0.0	-	0.3VLCD	V	-
Logic High Output Level	V_{OH}	0.8VLCD	-	VLCD	V	I_{OH} ≤1mA
Logic Low Output Level	V_{OL}	0.0	-	0.2VLCD	V	I_{OL} ≤1mA
Logic Input Leakage Current	IiL	-1.0	-	1.0	□A	VIN = 0 ~ VLCD

Rev.1.9

FALD Control Timing

Start transmission condition:
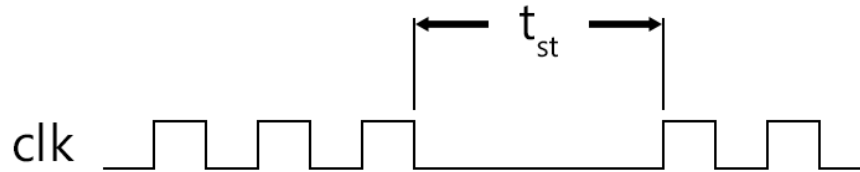
| Item	Symbol	Min	Typ	Max	Unit	Test Condition
Start Transmission time	t_{st}	10	-	-	µs	-

The data clock (CLK_MB_1V8) must be static for this period to begin a data transmission

Bit order
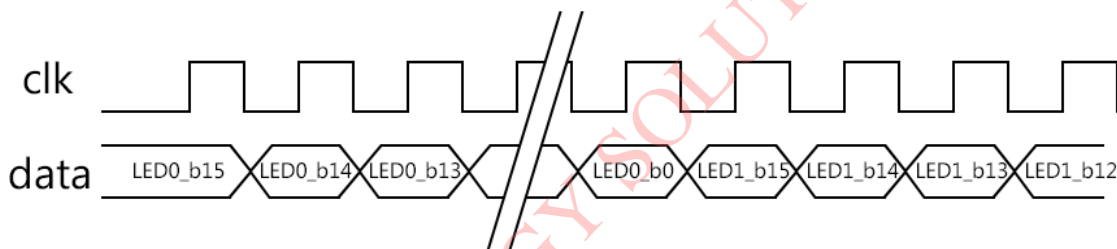
Data is to be transmitted on the rising edge of CLK MSB first starting at LED0; see scan direction reference below. Data must be transmitted for all LEDs for the panel to update brightness. To reject data prior to completing transmission, resend the start transmission condition.

Scan Direction reference
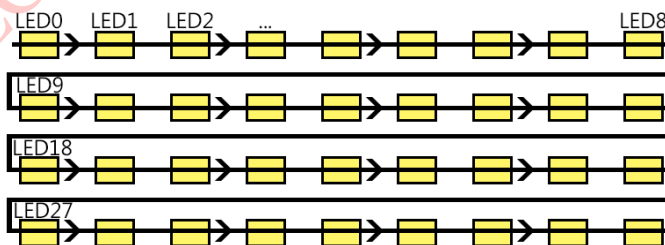
LED0 is in the upper left corner of the screen. LEDs increment left to right and continue incrementing on the left LED of the row below.

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Rev.1.9

Temperature sensing

On board temperature sensors are included to monitor different regions of the PCB. Two of LM75B are placed on the back side of the LCM. The FALD controller routinely gathers sensor data and will report back over the DATA_RETURN bus. One sensor's data will be reported over this bus every 500ms alternating between sensors 1 and 2. The full range of data is -55°C through +127°C at 0.125°C increments. See LM75B for bit definitions.

Item	Symbol	Min	Typ	Max	Unit	Test Condition
CLK_RETURN frequency	f_{clk}	-	78	-	kHz	simulation
Byte Time Delay	t_{dly}	-	58.89	-	µs	simulation
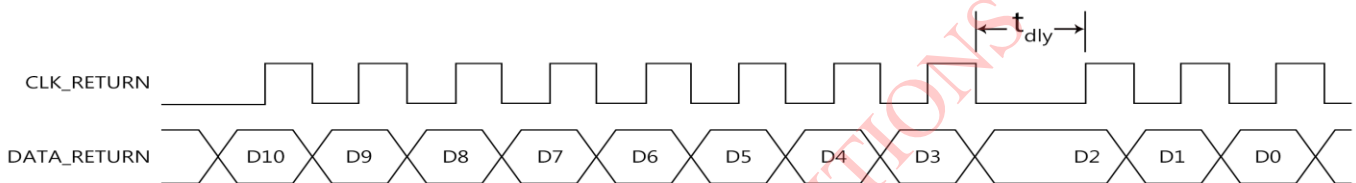
Temperature sensor location
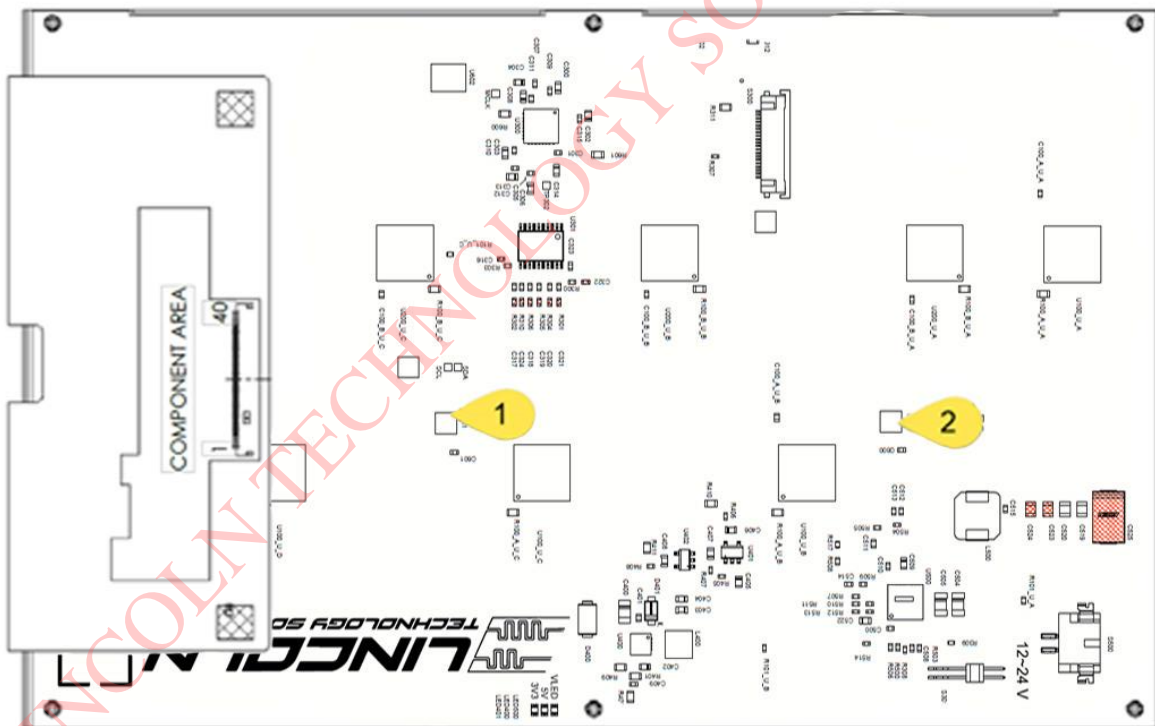
Positions 1 and 2 correspond to the temperature sensor locations.

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Rev.1.9

Optical Characteristics

The following measurements were made using a Klein Instrument K-80 contact probe. The aperture size of the Klein coupled with small size of the 7″ screen required changing the standard checkerboard pattern from 4*6 to 3*4.

Colorimetry Characteristics

Measurements are recorded after panel has been powered on for a minimum of 20 minutes.

Item	Symbol	Conditions	Specification			Unit	Note
			Min	**Typ**	**Max**		
Contrast Ratio	CR	Normal Viewing Angle	1200	10,000,000	-	-	(1)(3)
Red	x	LED ON	-	.6758	-	-	
	y		-	.3224	-		
Green	x	LED ON	-	.1672	-	-	
	y		-	.7523	-		
Blue	x	LED ON	-	.1464	-	-	
	y		-	.0883	-		
White Point	x	LED ON	-	.2679	-	-	
	y		-	.315	-	-	
Luminance	L	Ta = 25 °C	-	1800	-	cd/m2	(1)
Color Gamut	CG		105	110	-	%	DCI-P3
Response Time	T_{rt}	Ta = 25°C	-	11	20	ms	(1)(4)

Note 1: Measurement setup

The LCD module should be stabilized at a given temperature for 2 hours to avoid abrupt temperature change during measurement. After temperature saturation measurement should be executed.
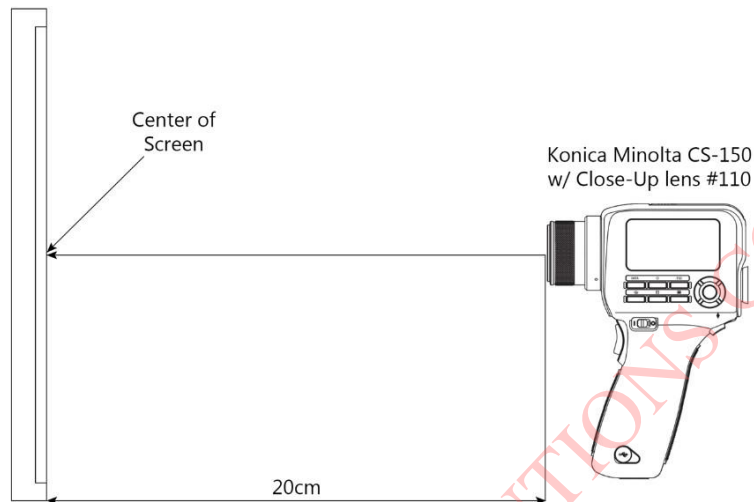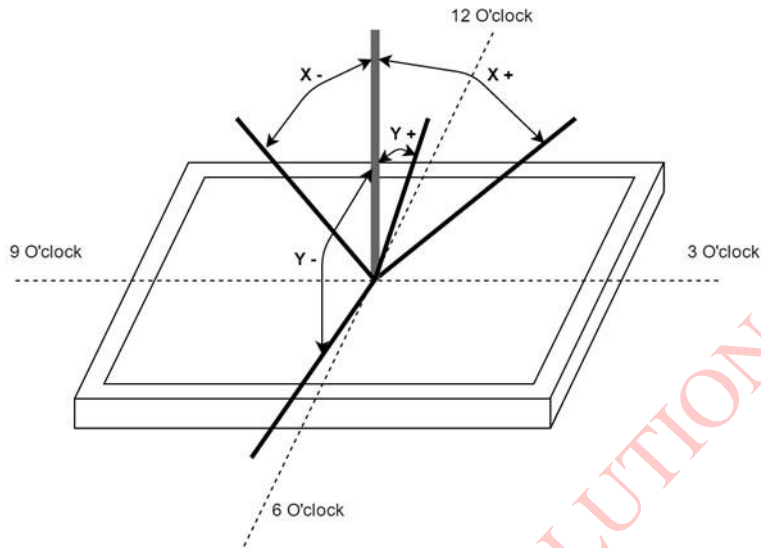

Note 2: Brightness Uniformity

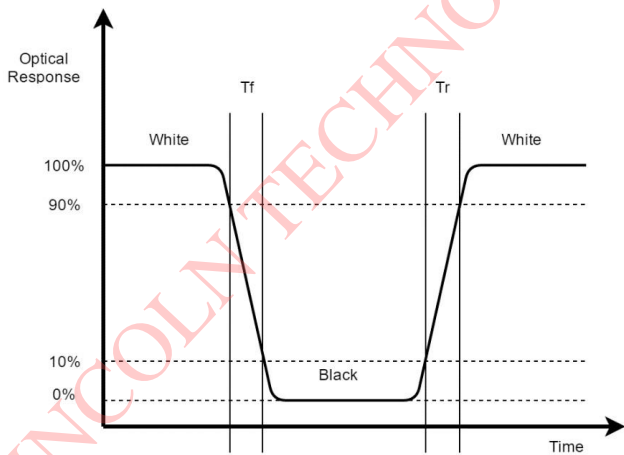Brightness uniformity = (Minimum Luminance of 5 points / Max Luminance of 5 points) * 100
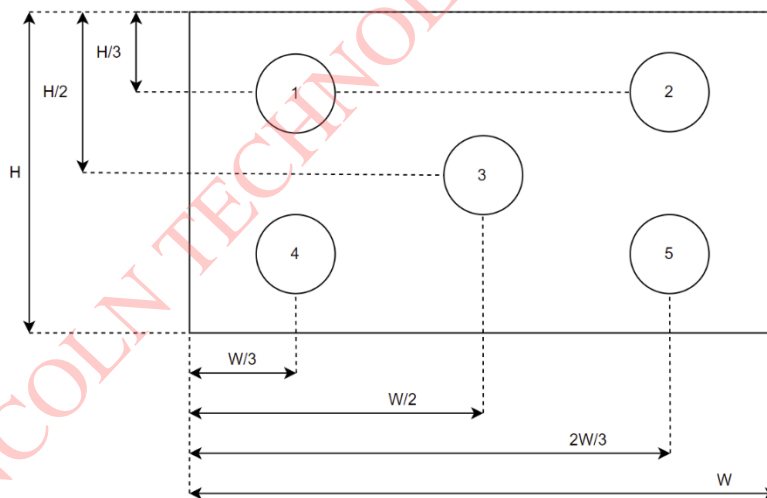
Note 3: Viewing Angle

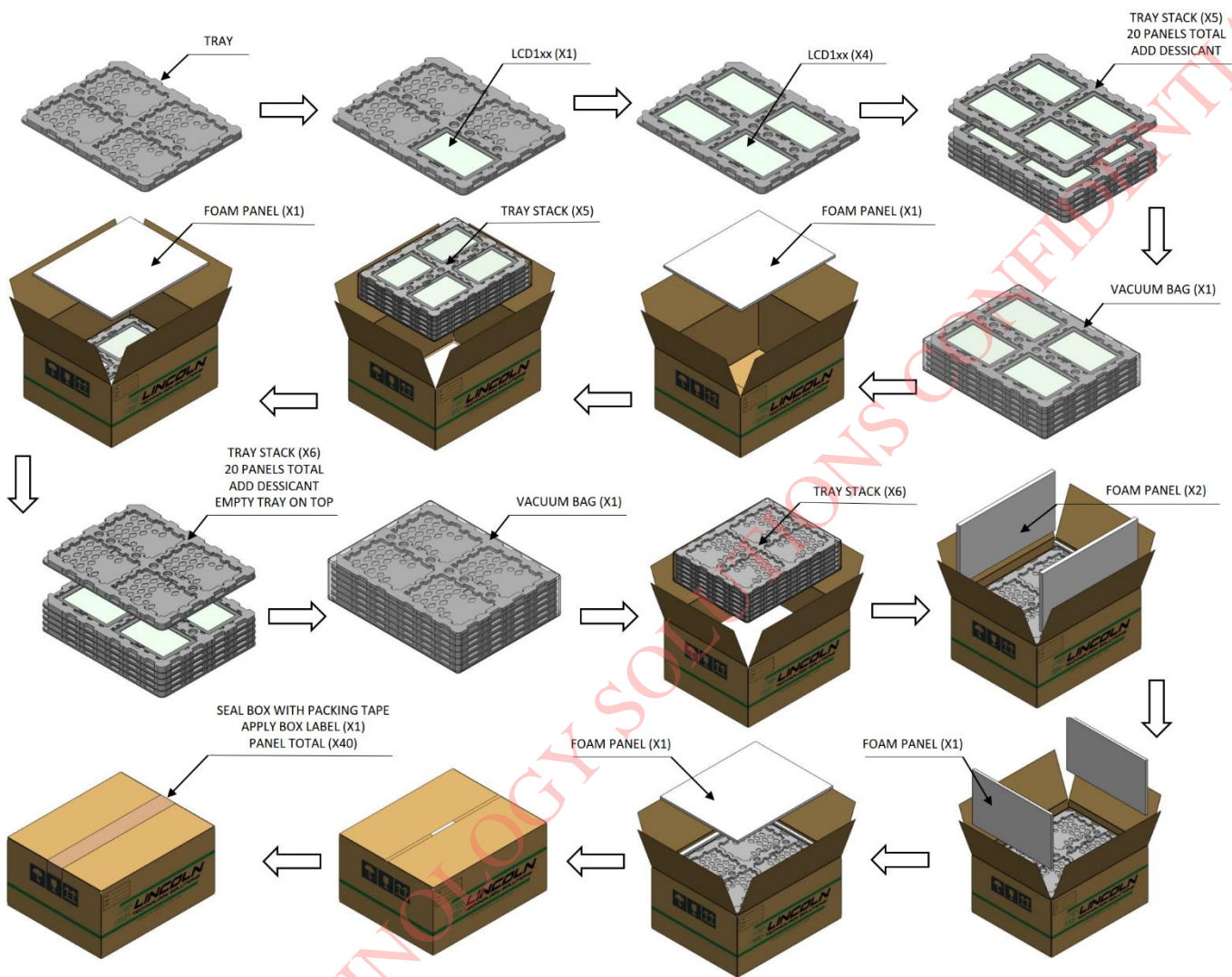Definition of viewing angle for Y+/- and X+/- is as follows.

Note 4: Response Time

Definition of response time as follows below.

Rev.1.9

Packaging

TRAY

LCD1xx (X1)

LCD1xx (X4)

TRAY STACK (X5)
20 PANELS TOTAL
ADD DESSICANT

FOAM PANEL (X1)

TRAY STACK (X5)

FOAM PANEL (X1)

VACUUM BAG (X1)

TRAY STACK (X6)
20 PANELS TOTAL
ADD DESSICANT
EMPTY TRAY ON TOP

VACUUM BAG (X1)

TRAY STACK (X6)

FOAM PANEL (X2)

SEAL BOX WITH PACKING TAPE
APPLY BOX LABEL (X1)
PANEL TOTAL (X40)

FOAM PANEL (X1)

FOAM PANEL (X1)

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.
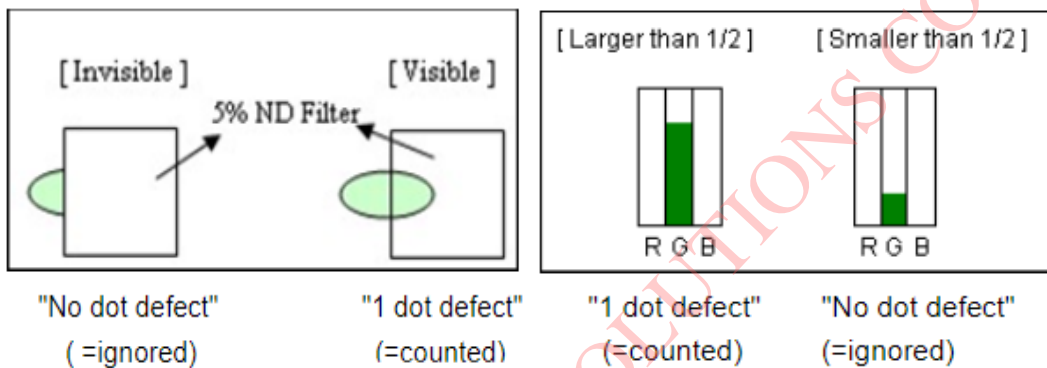

Dark Dot: Any single sub-pixel that does not light up in a white screen or another non-black screen is called a dark dot.

Rev.1.9
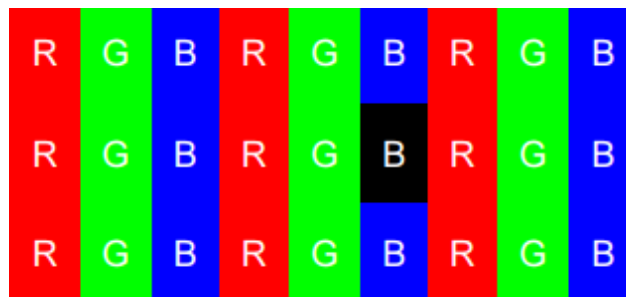
Two adjacent dots (horizontal direction): Use the bright dot illustration as an example to demonstrate two horizontal consecutive dots.
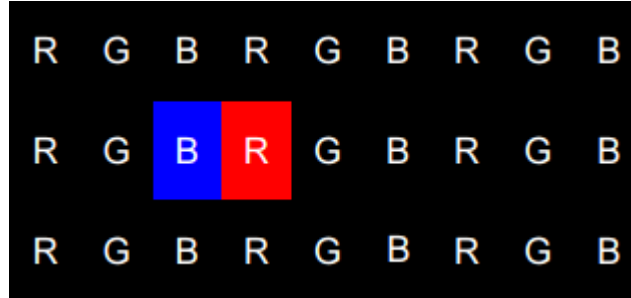
Two adjacent dots (vertical direction): Use the bright spot illustration as an example to demonstrate two vertical consecutive dots.
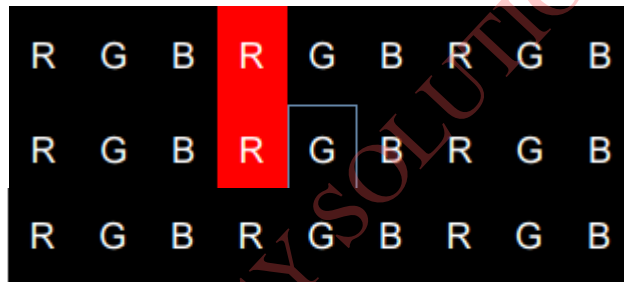
Two adjacent dots (bevel direction): Use the bright spot illustration as an example to demonstrate two consecutive dots in the bevel direction.

Rev.1.9
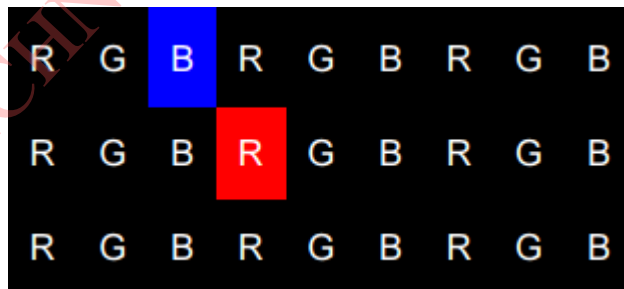
Three or more adjacent dots (horizontal): Use the bright spot illustration as an example to demonstrate three or more consecutive horizontal and vertical dots.
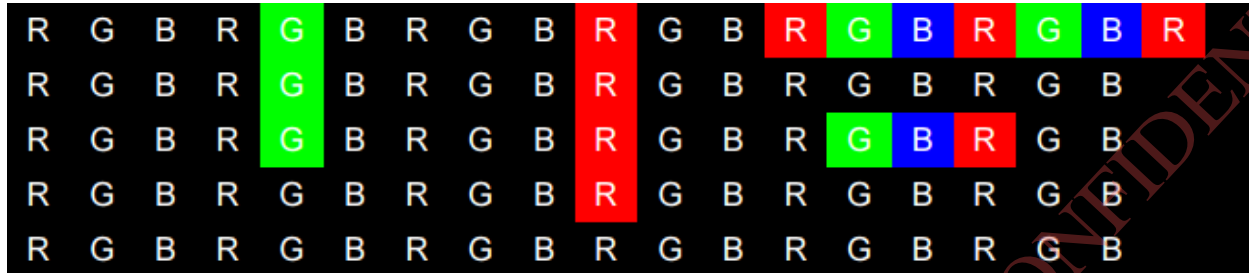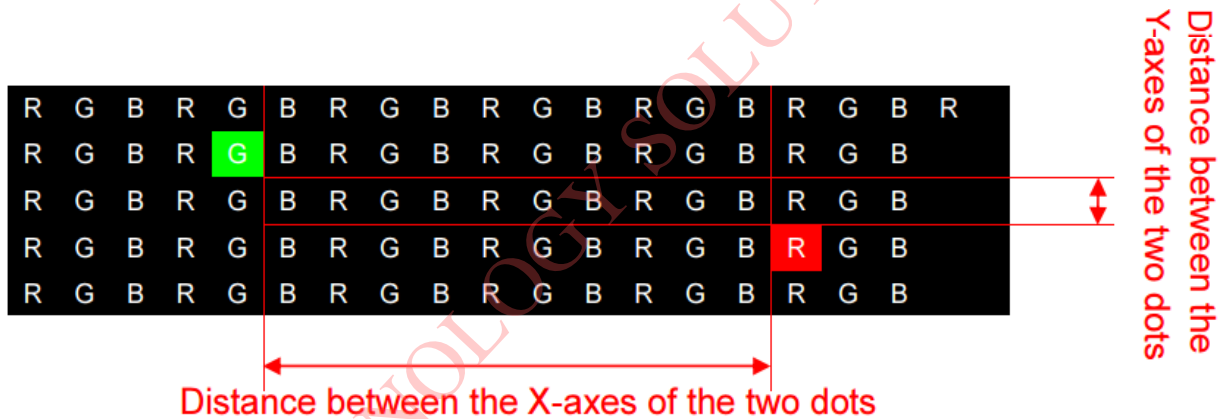

Illustration of spacing between two dots: (Distance is the relative distance between the X-axes of the two dots or the relative distance between the Y-axes of the two dots, whichever is larger)


Distance between the X-axes of the two dots

Distance between the Y-axes of the two dots

Functional Test

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

Rev.1.9

Newton's Ring
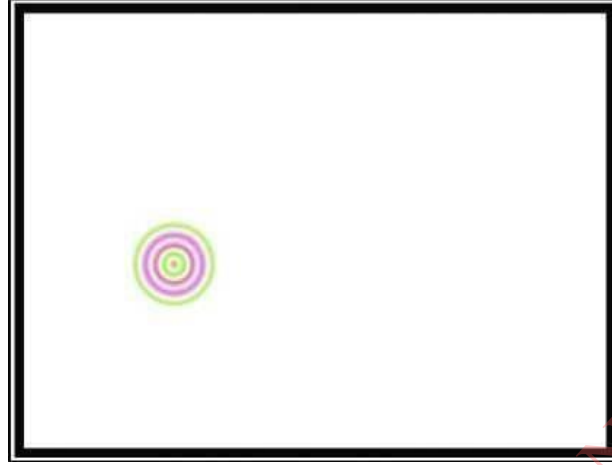
Under high temperature and high humidity conditions, uneven deformations caused by heat in different layers of the LCD module will result in the display of an all-white screen. However, this condition can be recovered when temperature is resumed under normal circumstances. A specific determination can 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 by both parties. (Ripples are not permitted at fixed locations. For ripples at non-fixed locations, they 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 display. 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 ≥ 0.5mm are not allowed: for those with diameters under 0.5 mm, 2 are acceptable if the space between them is ≥ 15mm. Card chromatic aberration ratio versus ND Filter: 1.0 + 0.3 standard = 5% ND Filer (see definition of Mura).

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Rev.1.9

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
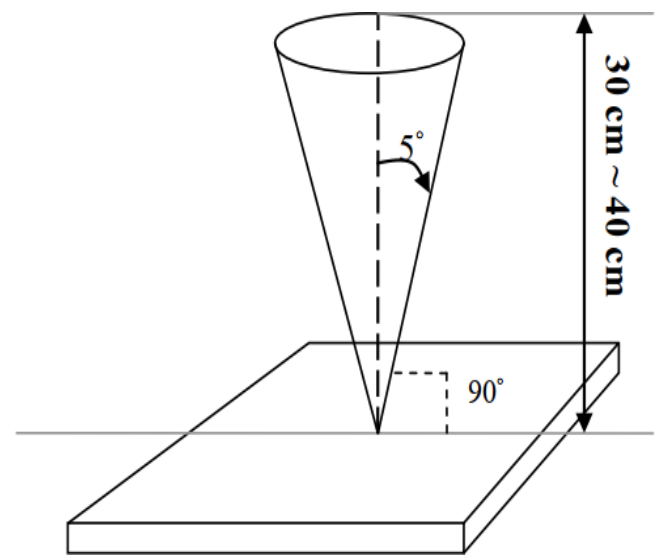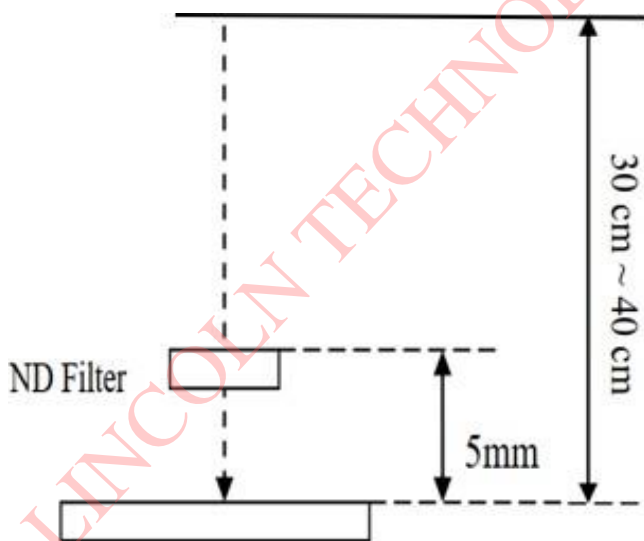
Inspection distance should be 35cm ± 5cm with a FujiFilm ND-LCD 5% filter approximately 5cm from the backlight surface.

Viewing angle: 90° ± 5°.

Room temperature: 23+/- 2°C

Humidity: 60 +/- 10%

Inspection Ambient Illumination: 300-700 LUX

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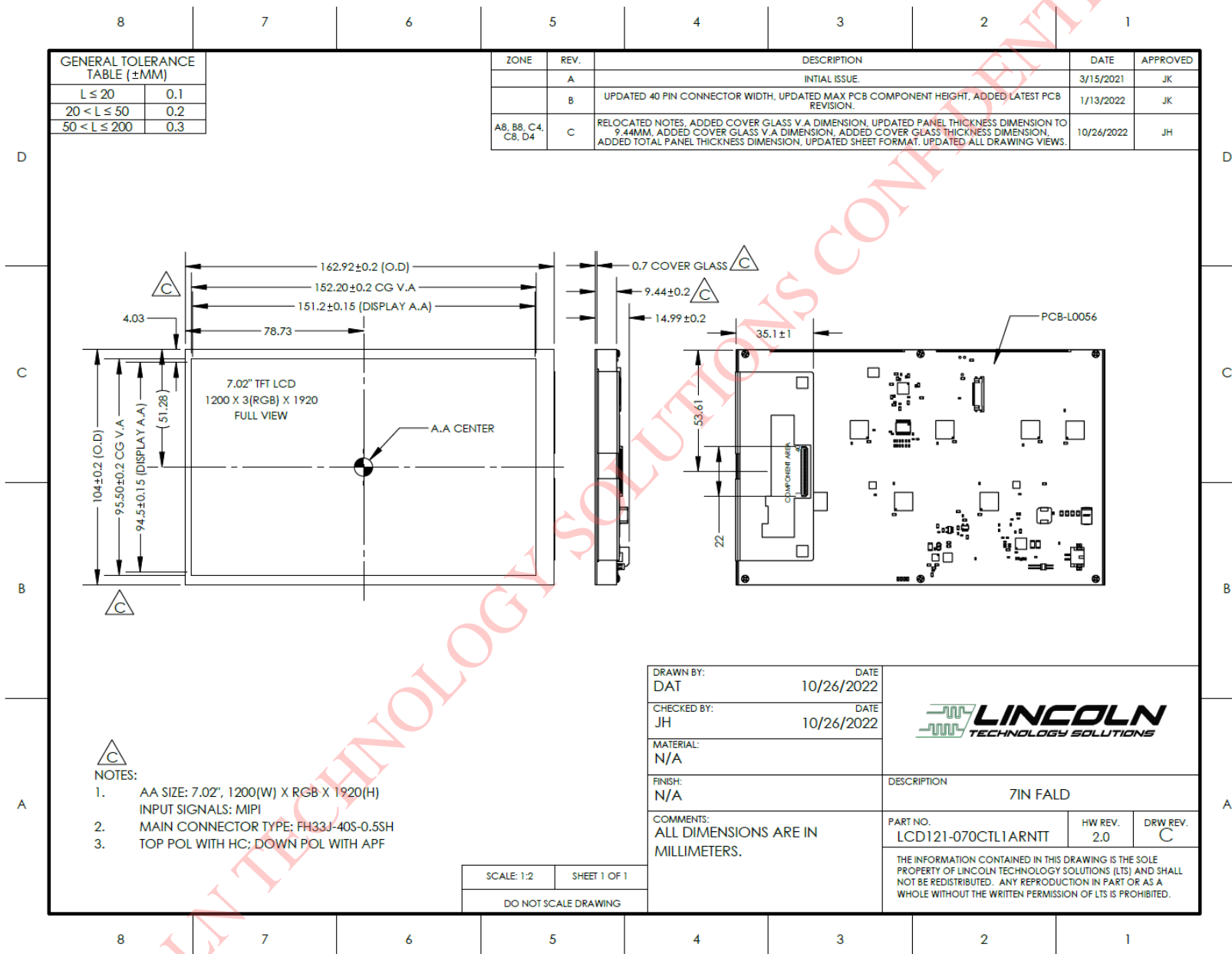
Acceptance Criteria Table

There should be no corrosion or cracking, or an uneven coating layer on LCD display 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	FALD Zone	Acceptance Qty.
Unfelt scratch visible with backlight off.	W<0.05	Ignore
	W>0.05 and <0.1 L>0.3 and <3.0	4
	W>0.1 or L>3.0	None
	Visible with backlight on	None
Felt scratch	None Allowed	
Dent visible with backlight off	D<0.2	Ignore
	D>0.2 and <0.5	5
	Spacing between defects must be >30mm	
	D>0.5	None
	Visible with backlight on	None
Bubble visible with backlight off	D<0.2	Ignore
	D>0.2 and <0.5	5
	D>0.5	None
	Visible with backlight on	None

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Foreign material (line shape) visible with backlight on	W<0.05	Ignore
	W>0.05 and <0.1 L>0.3 and <2.0	4
	W>0.1 or L>2.0	None
Foreign material (dot shape) visible with backlight on	D<0.2	Ignore
	D>0.2 and <0.5	5
	D>0.5	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
Any stuck or dead LED on BLU is not acceptable		

Rev.1.9

Appendix 1: Mechanical Drawing

Rev.1.9

	8	7	6	5	4	3	2	1	

GENERAL TOLERANCE TABLE (±MM)

L ≤ 20	0.1
20 < L ≤ 50	0.2
50 < L ≤ 200	0.3

ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	INTIAL ISSUE.	3/15/2021	JK
	B	UPDATED 40 PIN CONNECTOR WIDTH, UPDATED MAX PCB COMPONENT HEIGHT, ADDED LATEST PCB REVISION.	1/13/2022	JK
A8, B8, C4, C8, D4	C	RELOCATED NOTES, ADDED COVER GLASS V.A DIMENSION, UPDATED PANEL THICKNESS DIMENSION TO 9.44MM, ADDED COVER GLASS V.A DIMENSION, ADDED COVER GLASS THICKNESS DIMENSION, ADDED TOTAL PANEL THICKNESS DIMENSION, UPDATED SHEET FORMAT. UPDATED ALL DRAWING VIEWS.	10/26/2022	JH

162.92±0.2 (O.D)
152.20±0.2 CG V.A
151.2±0.15 (DISPLAY A.A)
4.03
78.73

0.7 COVER GLASS
9.44±0.2
14.99±0.2
35.1±1

PCB-L0056

7.02" TFT LCD
1200 X 3(RGB) X 1920
FULL VIEW

A.A CENTER

104±0.2 (O.D)
95.50±0.2 CG V.A
94.5±0.15 (DISPLAY A.A)
(51.28)

53.61
22

COMPONENT AREA

NOTES:
1. AA SIZE: 7.02", 1200(W) X RGB X 1920(H)
    INPUT SIGNALS: MIPI
2. MAIN CONNECTOR TYPE: FH33J-40S-0.5SH
3. TOP POL WITH HC; DOWN POL WITH APF

DRAWN BY:	DATE			
DAT	10/26/2022			
CHECKED BY:	DATE			
JH	10/26/2022			

LINCOLN TECHNOLOGY SOLUTIONS

MATERIAL: N/A	
FINISH: N/A	DESCRIPTION: 7IN FALD
COMMENTS: ALL DIMENSIONS ARE IN MILLIMETERS.	

PART NO.	HW REV.	DRW REV.
LCD121-070CTL1ARNTT	2.0	C

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SCALE: 1:2	SHEET 1 OF 1
DO NOT SCALE DRAWING	

Rev.1.9