LCD304-101CTL1ARNTT

10.1" Rugged Display

1280 x 720

111 Corning Road, Suite 116 • Cary, NC 27518

Approvals	
Model Number	LCD304-101CTL1ARNTT
Datasheet Revision	0.1
Drawing Revision	G

Customer Approval
Approved by: _____ Date: _____

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Revision History

Document Revision

Date	Version #	Description	Created By	Checked By	Quality Approval By	Approved By
9.12.2025	0.1	Preliminary Release	ST	LH	--	JH

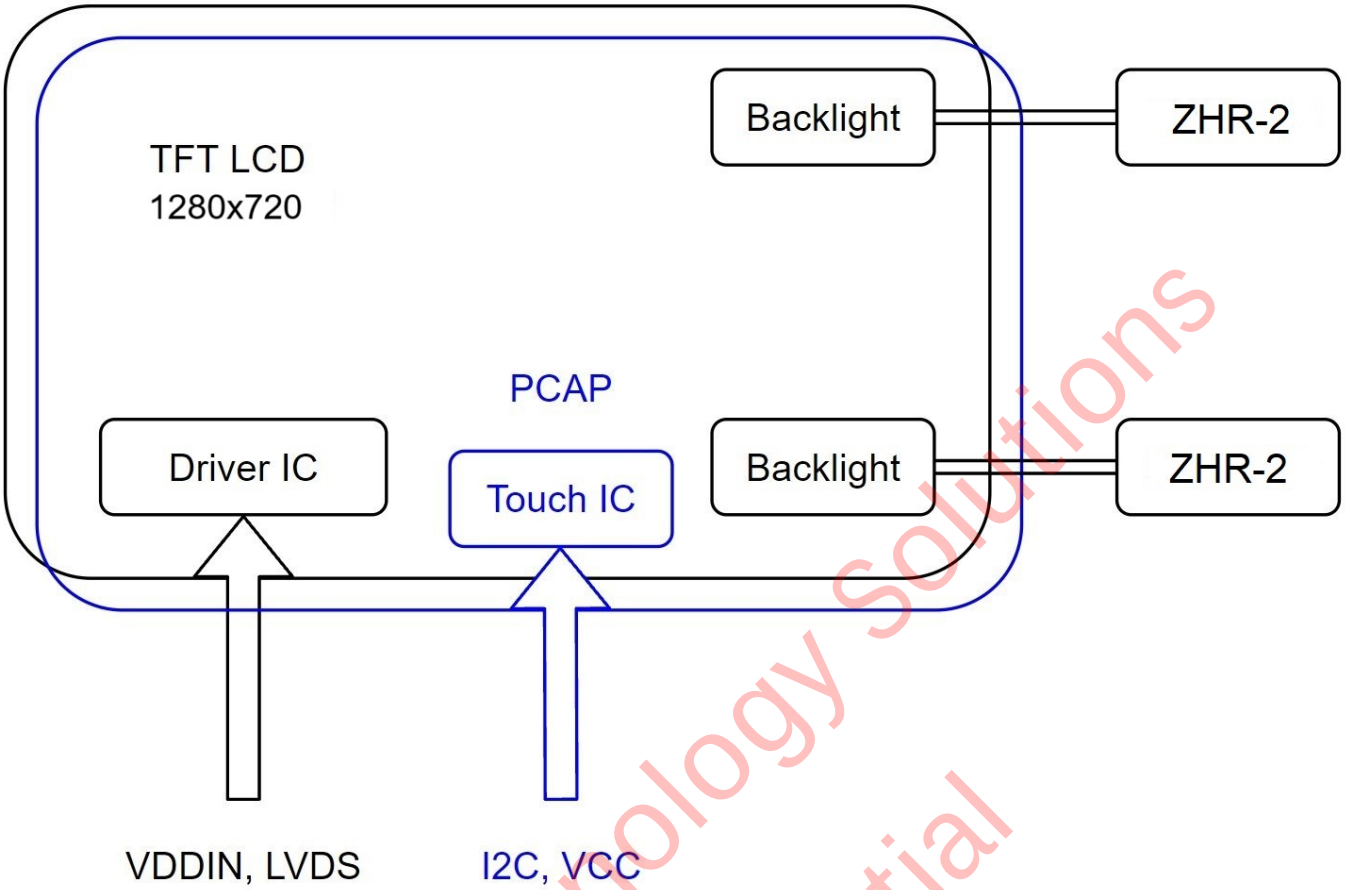
Hardware Revision

Date	Version #	Description
12.12.2024	0.1	Initial Release
3.3.2025	0.2	FOG updated. Interim updated 6.17.2025 for new OCA between FOG-TP
7.7.2025	0.3	New OCA in TP bond

General Specification

Item	Specification	Unit
Active Area	223.68(H) x 125.82(V)	mm
Backlight Type	Edge Lit	-
Display Size (Diagonal)	10.1"	inch
Driver IC	Himax HX8249-A00 and HX8695-e00	-
Interface	1 port LVDS (DE mode only)	-
LCD Color Depth	TFT 16.7M (RGB888)	-
LED Color	White	-
Luminance	2000 (maximum)	cd/m2
Number of Dots	1280 (RGB) x 720	-
Outline Dimensions	261.16(H) x 173.66(V) x 9.47(D)	mm
Pixel Size	0.17475(W) x 0.17475(H)	mm
Surface Coating	Cover Lens with Anti-Reflective and Anti-Fingerprint	-
Surface Hardness	>7H	-
Temperature (Storage)	-40 to 90	°C
Temperature (Operating)	-30 to 85	°C
Touch Controller	EXC81W46	-
Viewing Direction	All	-

Block Diagram



Pin-Out - LCD

The 10.1" LCD has an I-PEX 20647-040E-01, 40 position connector.

Number	Symbol	I/O	Description
1	NC	-	No connection
2	VDD	P	External main and I/O power supply; Power3V3
3	VDD	P	External main and I/O power supply; Power3V3
4	NC	-	No connection
5	RESET	I	Global reset pin
6	STBYB	I	Standby mode setting pin
7	GND	P	Power GND
8	RXIN0-	I	LVDS data 0-
9	RXIN0+	I	LVDS data 0+
10	GND	P	Power GND
11	RXIN01-	I	LVDS data 1-
12	RXIN01+	I	LVDS data 1+
13	GND	P	Power GND
14	RXCLKIN-	I	LVDS clock -
15	RXCLKIN+	I	LVDS clock +
16	GND	P	Power GND
17	RXIN02-	I	LVDS data 2-
18	RXIN02+	I	LVDS data 2+
19	GND	P	Power GND

20	RXIN03-	I	LVDS data 3-
21	RXIN03+	I	LVDS data 3+
22	GND	P	Power GND
23	SCL	I	Serial interface clock input for 3 wire SPI interface. If not used, please keep no connection
24	SDA	I/O	Serial interface address and data input/output for 3 wire SPI interface. If not used, please keep no connection
25	GND	P	Power GND
26	CSB	I	Serial interface enable input for 3 wire SPI interface. If not used, please keep no connection
27	NTC_GND	-	No connection
28	SELB(DINT)	I	Input Input data format selection DINT=1: 8 bit (Default) DINT=0: 6 bit
29	NC	-	No connection
30	GND	P	Power GND
31	LED-	P	No connection
32	LED-	P	No connection
33	L/R	I	Horizontal shift direction (source output) selection RL=1: Left -> Right (Default) RL=0: Right -> Left
34	U/D	I	Vertical shift direction (gate output) selection TB=1: Top -> Bottom (Default) TL=0: Bottom -> Top
35	NTC	I	No connection
36	NC	-	No connection
37	VDD_OTP	I	No connection

38	NC	-	No connection
39	LED+	P	No connection
40	LED+	P	No connection

Pin Out – PCAP

I2C

The PCAP tail has gold plated contacts spaced at 0.5mm pitch. It is recommended to use a mating connector such as Hirose 6 position, 0.5mm pitch, MPN: FH34SRJ-6S-0.5SH (50).

Number	Symbol	I/O	Description
1	VCC	P	Power Supply (3.3V)
2	RST	I	Reset signal (1.8V)
3	INT	O	Interrupt out (1.8V)
4	SCL	I	Serial Clock (1.8V)
5	SDA	I/O	Serial Data (1.8V)
6	GND	P	Ground

USB

1.25 mm pitch, single row, 4 Pin USB Molex 53261-0471

Number	Symbol	I/O	Description
1	VCC	P	Power Supply
2	USBN	I/O	USB Negative
3	USBP	I/O	USB Positive
4	GND	P	Ground

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 Voltage	VDD	-0.3	3.96	V
Input Signal Voltage	Vi	-0.3	VDD	V
Operating Temperature	T_{OPR}	T_a=-30	T_p=85	°C
Storage Temperature	T_{STG}	T_a=-40	T_a=90	°C

Note 1: T_a=Ambient Temperature, T_p=Panel Surface Temperature

Absolute Max Ratings – PCAP

Item	Symbol	Value	Unit
Operating Voltage	VCC	3.0-3.6V	V
I/O Supply Voltage	IOVCC	3.0-3.6V	V

Electrical Characteristics – LCD

Item	Symbol	Min	Typ	Max	Unit	Condition
Power Supply Voltage	VDD	3	3.3	3.6	V	Ta = 25C
Power Supply Current	I_{VDD}	-	35.5	60	mA	
Input Voltage	V_{IH}	0.7VDD	-	VDD	V	
	V_{IL}	GND	-	0.3VDD	V	

Electrical Characteristics – PCAP

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Power Supply Voltage	VCC	3.0	3.3	3.6	V	-
I/O Supply Voltage	IOVCC	3.0	3.3	3.6	V	-
Power Supply Current	ICC	-	-	200	mA	-
Input Voltage	V_{ih}	0.8*VDD	-	-	V	-
	V_{il}	-	-	0.4	V	-
Output Voltage	V_{oh}	VDD-0.4	-	-	V	I=2mA
	V_{ol}	-	-	0.4	V	I=2mA

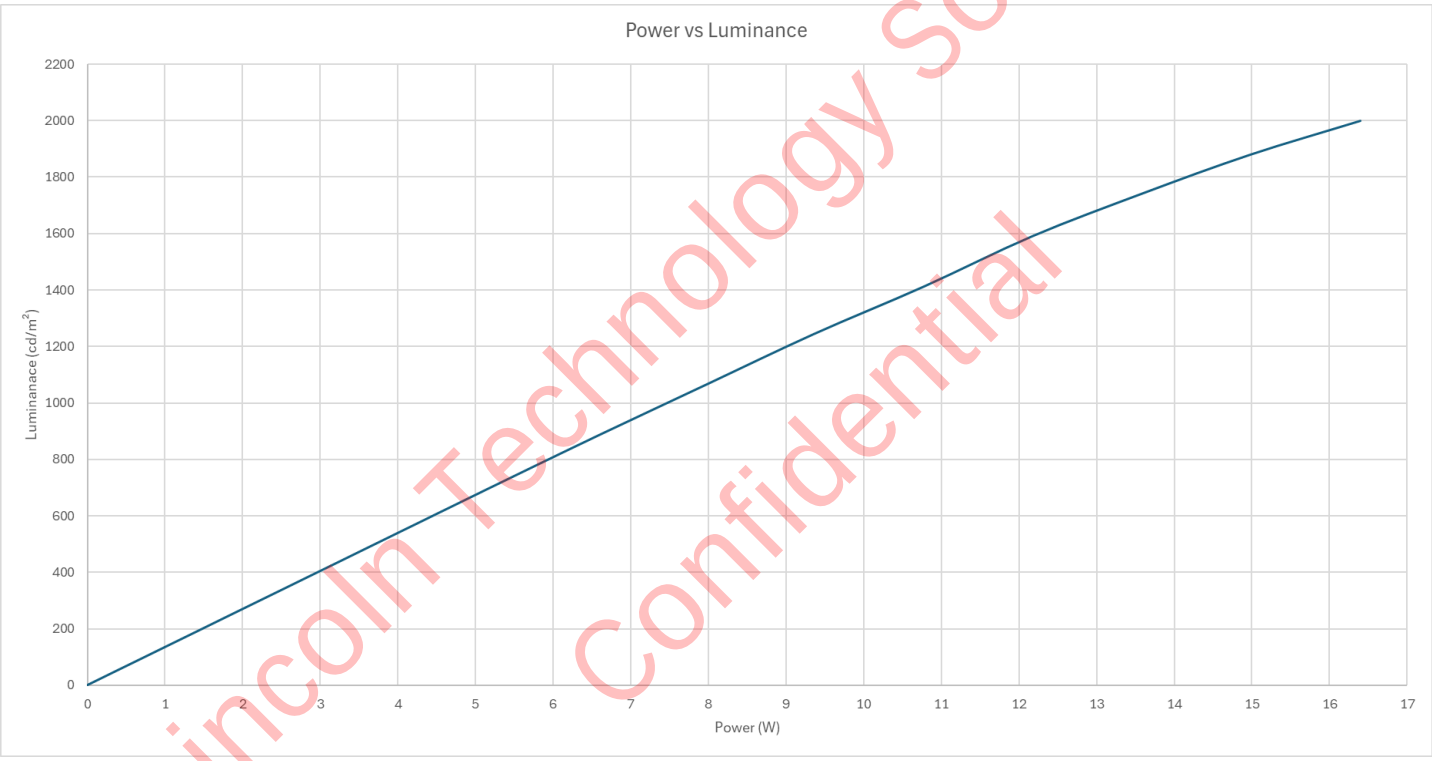
Backlight Specifications

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., 299 mA per backlight connector is required for a total of 598 mA (maximum) at 2000 NITS.

Item	Symbol	Min	Typ	Max	Unit	Condition
Supply Voltage	V_f[1]	-	-	27.4	V	-
Supply Current	I_f	-	-	598	mA	2000 Nits

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

Note 2: Conditions described here are maximum conditions based on IEC 62368-1.



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

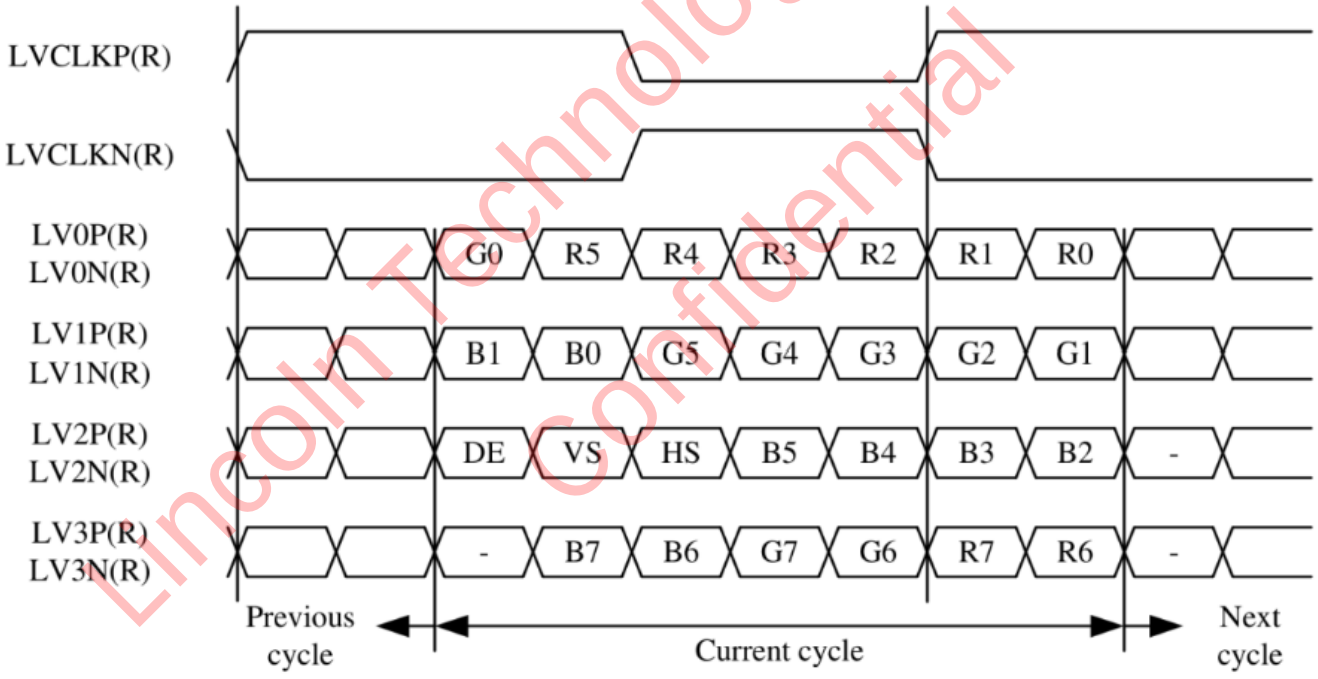
Please refer to driver IC (Himax HX8249-A00 and HX8695-e00) datasheet.

LVDS Timing

Item	Symbol	Min	Typ	Max	Unit
DCLK Frequency	Fclk	58.5	63.7	76.3	MHz
Period	T_H	1336	1340	1472	CLK
Horizontal Display Area	T_{HD}		1280		CLK
Blanking	T_{HB}	56	60	192	CLK
Period	T_V	730	792	864	HS
Vertical Display Area	T_{VD}		720		HS
Blanking	T_{VB}	10	72	144	HS

Note: DE mode only

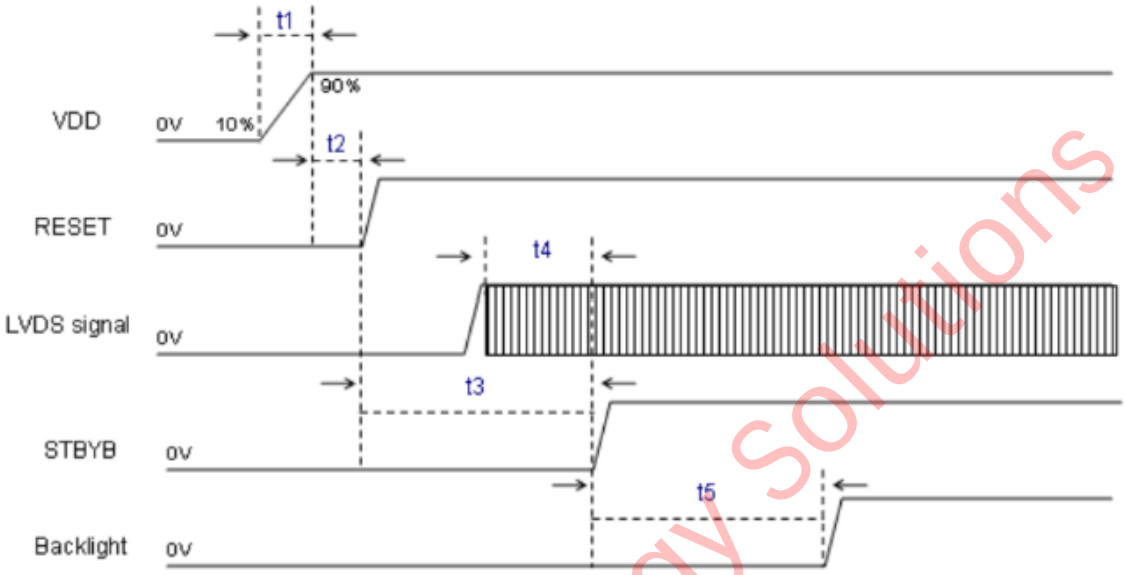
LVDS, 8 bit, VESA format:



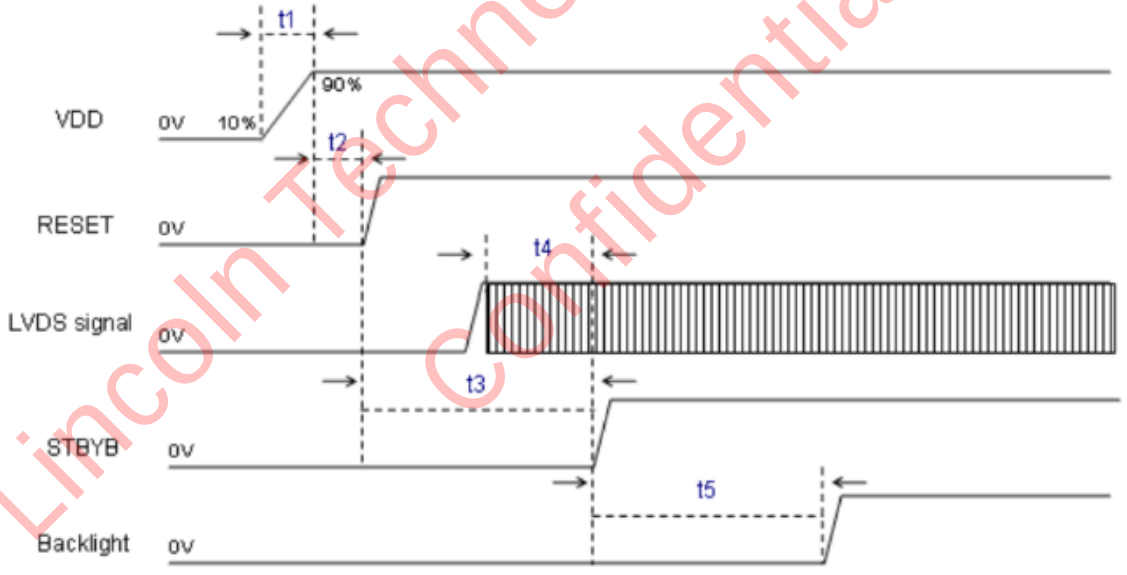
Power ON/OFF Sequence

VDD=3.0-3.6V

a. Power On



b. Power Off:

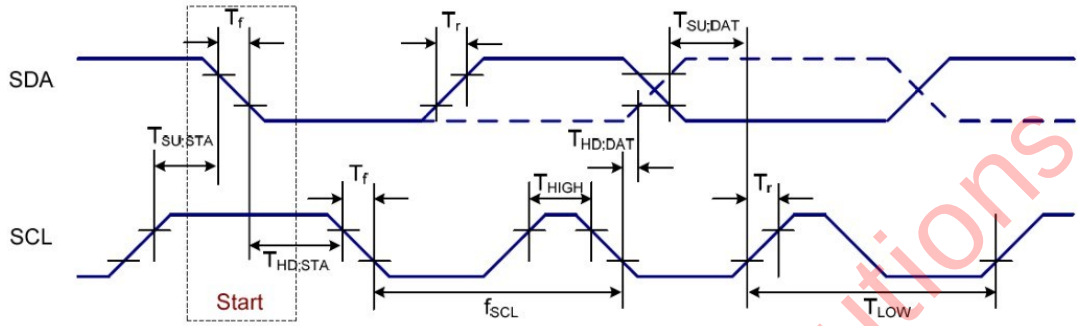


Parameter	Min	Typ	Max	Unit
T1	0.5	5	10	ms
T2	30	40	50	ms
T3	10	15	20	ms
T4	1	5	T3	ms
T5	118	119	T6	ms
T6	120	128	135	ms
T7	0.5	5	10	ms
T8	0	5	10	ms
T9	500	650	800	ms

Timing Specifications – PCAP

Refer to GT928 datasheet.

Standardized timings provided for reference.



Symbol	Parameter	Min	Typ	Max	Unit
f_{SCLK}	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
Tr	SCL and SDA rise time	20	-	300	ns
Tf	SCL and SDA fall time	20	-	300	ns
Tf	SDA fall time for read out	20	-	1000	ns
Cb	Capacitive load represented by each bus line	-	-	400	pF
$TS_{SU;STA}$	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

Reliability (Preliminary)

The reliability test items and conditions are specified in the table below.

Criteria include:

1) Samples shall be functional with no safety-related failures such as fire, smoke or electrical shock during and after the test.
2) No screen quality deterioration at interim functional checks and after the tests monitoring
    a. Luminance > 50% of initial turn on luminance
    b. Uniformity within 25% of initial sample
    c. Passing visual test
3) No cosmetic deterioration at interim check and after test
4) No mechanical or physical damage

Item	Test	Conditions
1	High Temperature Operation	80°C 1000Hr; Notes 1, 2
2	Low Temperature Operation	-30°C 1000Hr
3	High Temperature Storage	90°C 1000Hr
4	Low Temperature Storage	-40°C 1000Hr
5	Thermal Shock	-40°C & 90°C, 1Hr/cycle for 1000 cycles
6	High Temperature and Humidity Operation	60°C 90%RH 1000Hr
7	Vibration - Structural	5G Peak Acceleration, 10Hz-1000Hz-10Hz; 3 mutually perpendicular axes X, Y, and Z, 8Hr/axis.
8	ESD	+/- 2kV to +/- 8kV Air +/- 2kV to +/- 6kV contact; Note 3
9	UV/Solar Radiation	Irradiance of 1120W/m^2, 56 cycles of 20Hr light/4Hr dark. Note 4
10	Impact Resistance Rating	IK08, Note 5

Note 1: High Temperature Operation

Backlight power must be decreased at elevated temperatures. Test conducted at 4W total backlight power, equivalent to approximately 500 nits at ambient 25°C.

Note 2: High Temperature Operation Limit

Test conditions for high temperature operational test result in an 85°C LCD cell temperature.

Note 3: ESD Criteria

Unit may have temporary graphical artifacts during shock.

Note 4: Spectral Power Distribution

Spectral Region	Bandwidth (nm)	Irradiance (W/m^2)	Spectral Region Irradiance (W/m^2)
Ultraviolet-B	280-320	5.6	5.6
Ultraviolet-A	320-360	26.9	62.7
	360-400	35.8	
Visible	400-520	200.5	580.2
	520-640	185.9	
	640-800	193.8	
Infrared	800-3000	471.5	471.5
	Totals	1120	1120

Note 5: Impact Resistance

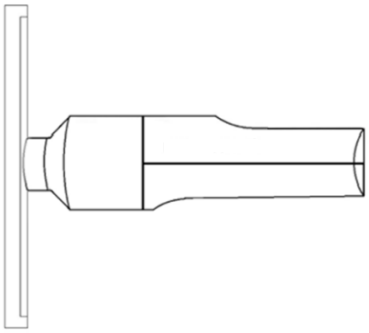
Testing conducted with a 1700g steel ball dropped from a height of 29.5cm above the cover glass surface. The LCD module is mounted to an aluminum test jig using the pre-installed tape on the rear of the cover glass.

Optical Characteristics

Item		Symbol	Conditions	Specifications			Unit	Note
				Min.	Typ.	Max.		
Contrast Ratio		CR		600	1000	-	--	(1)(3)(5)
Response Time		Ton + Toff	Ta= 25 °C	-	25	-	ms	(1)(4)
Viewing Angle	Hor.	X-		-	85	-	Deg.	(3)(5)
		X+		-	85	-		
	Ver.	Y+		-	85	-		
		Y-		-	85	-		
Chromaticity	Red	Rx	Ta= 25 °C	-	0.683	-	--	
		Ry		-	0.309	-	--	
	Green	Gx		-	0.265	-	--	
		Gy		-	0.655	-	--	
	Blue	Bx		-	0.154	-	--	
		By		-	0.068	-	--	
	White	Wx		-	0.329	-	--	
		Wy		-	0.336	-	--	
Color Gamut Coverage				-	92	-	%	DCI-P3
Color Gamut Ratio				-	93	-	%	DCI-P3
Luminance		L	Ta= 25 °C	-	-	2000	cd/m2	(1)
Uniformity		U		-	86	-	%	(2)

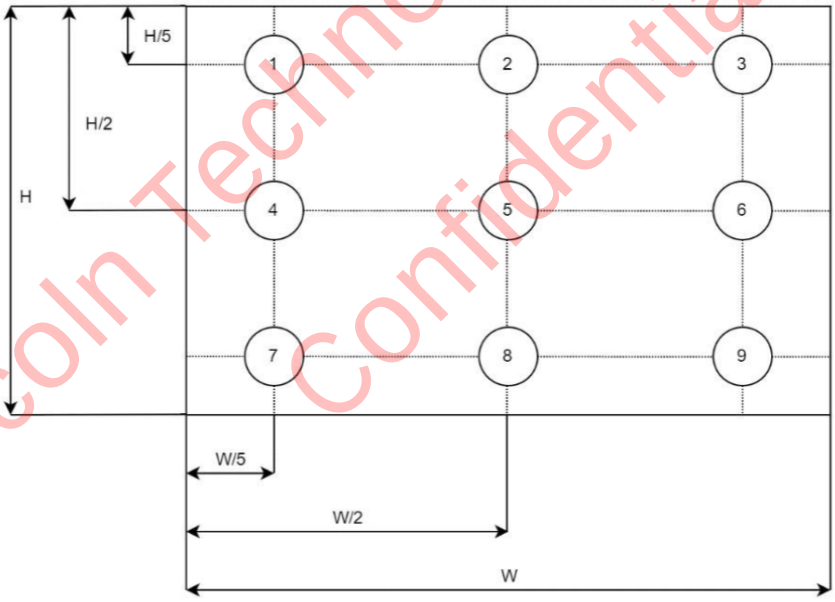
Note (1) Definition of Measurement Setup:

The LCD module should be stabilized at a given temperature for 25 minutes to avoid abrupt temperature change during measurement. After temperature saturation, measurement should be executed. Measurements are conducted with a colorimeter with the aperture in contact with the display.

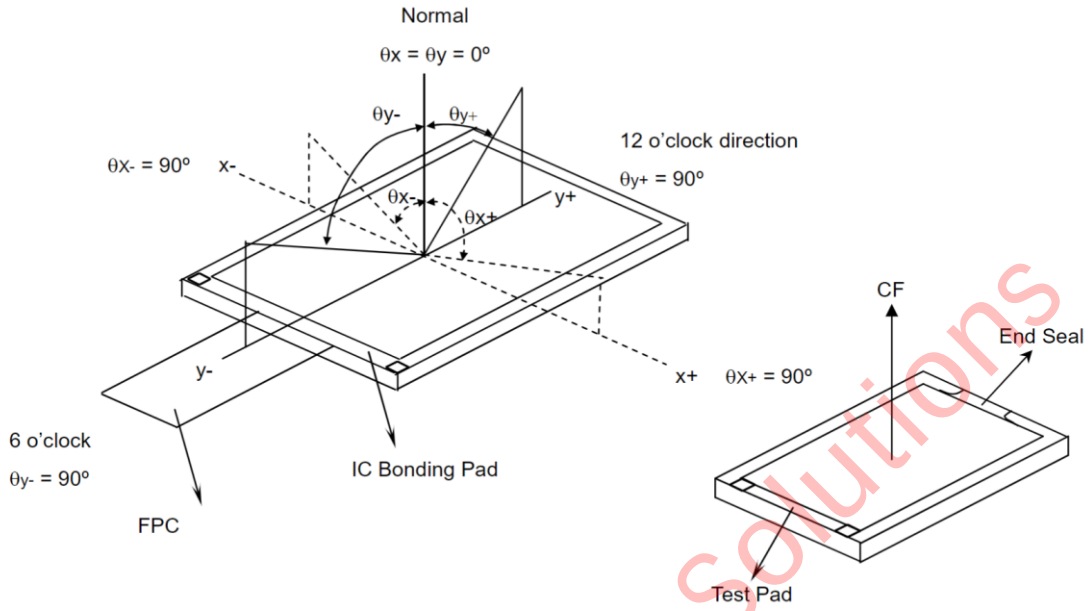


Note (2) Definition of Brightness Uniformity

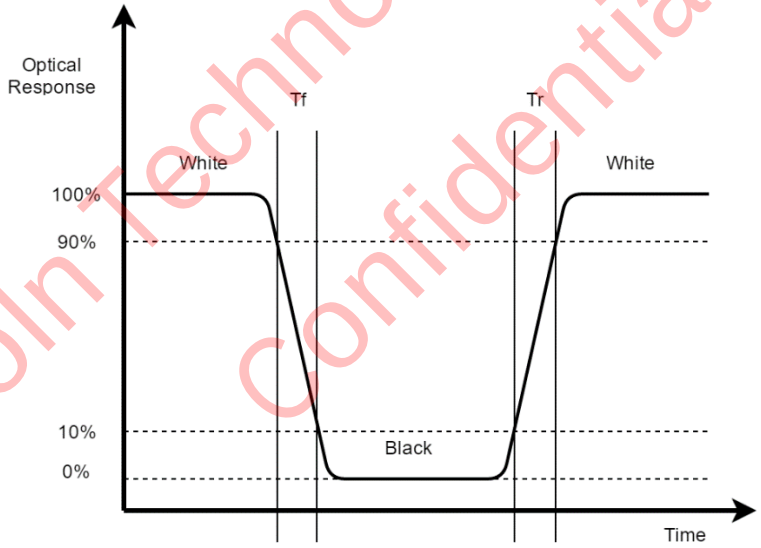
$$\text{Brightness Uniformity} = \frac{Minimum\ Luminance\ of\ 9\ points}{Max\ Luminace\ of\ 9\ points} * 100$$



Note (3) Definition of Viewing Angle



Note (4) Definition of Response Time (T_{on}, T_{off}):

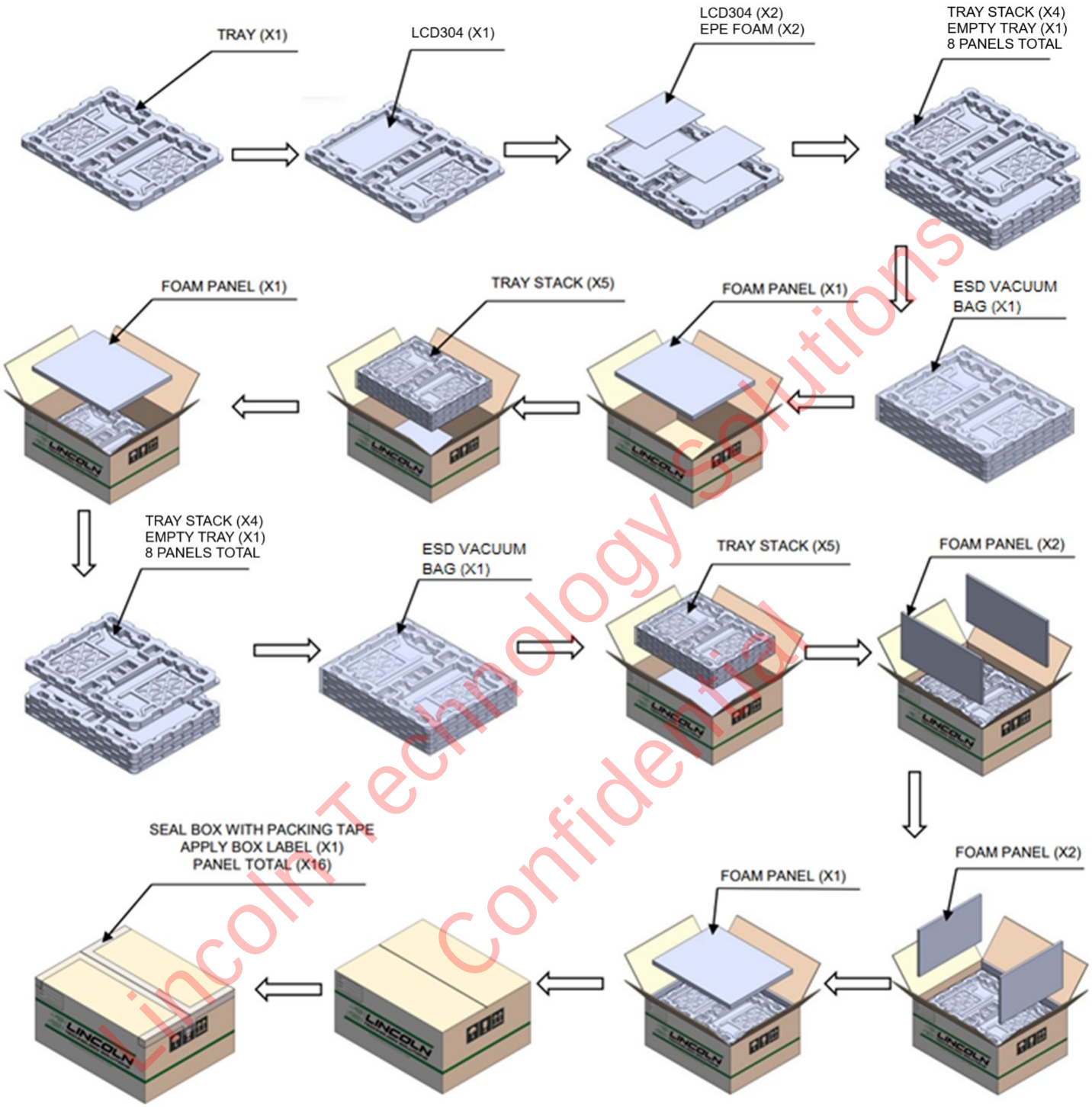


Note (5) Definition of Contrast Ratio:

Contrast measurements shall be made at a viewing angle of 0° at the center of the surface

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

Packaging

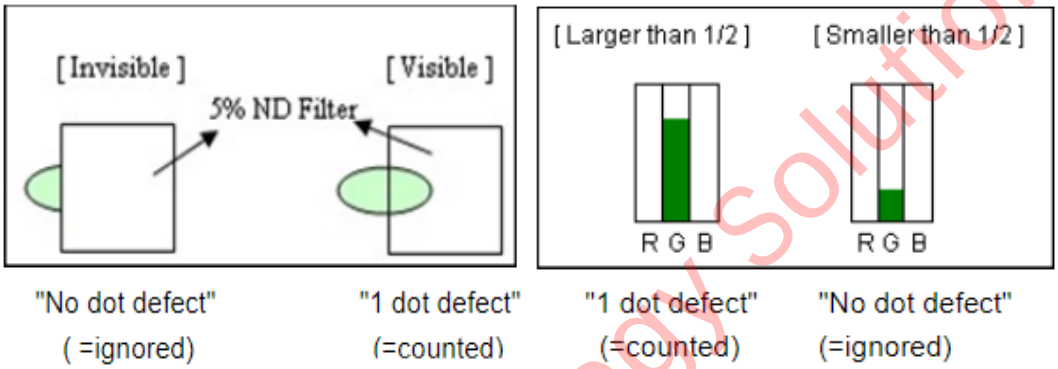


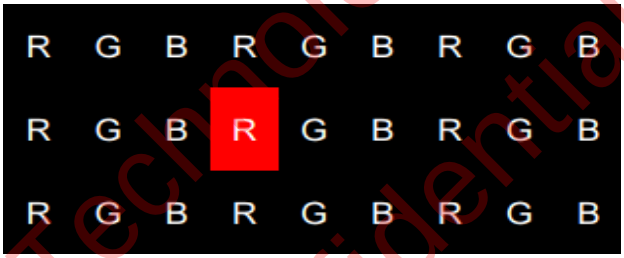
Quality & Inspection Criteria

Terminologies

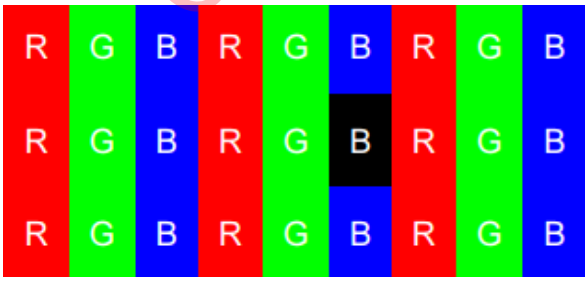
LCD: Liquid Crystal Display; Each pixel contains three dots of R, G, and B (sub-pixel).

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.

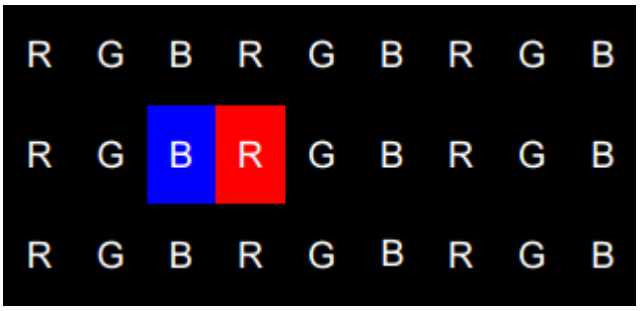




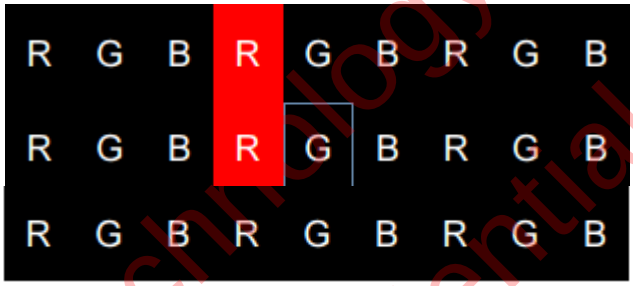
Dark Dot: Any single sub-pixel that does not light up on a white screen or another non-black screen is called a dark dot.



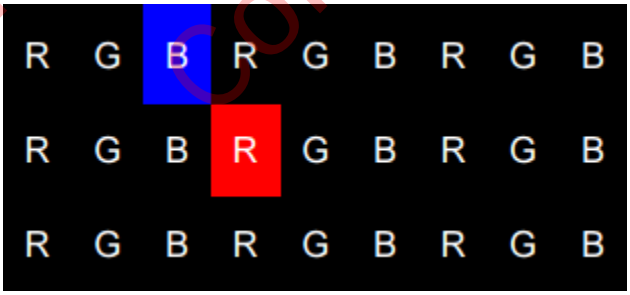
Two adjacent dots (horizontal direction): Use the bright dot illustration as an example to demonstrate two horizontal consecutive dots.



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

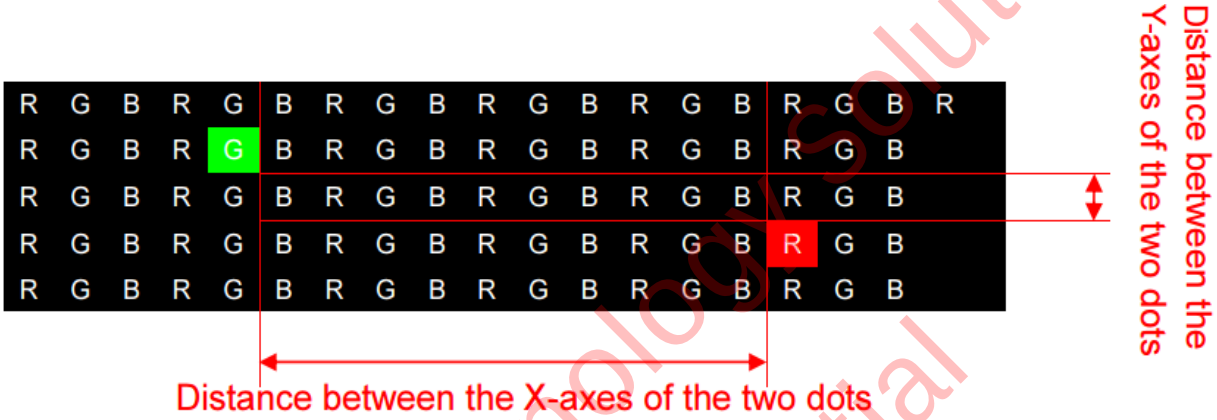


Two adjacent dots (bevel direction): Use the bright spot illustration as an example to demonstrate two consecutive dots in the bevel direction



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)



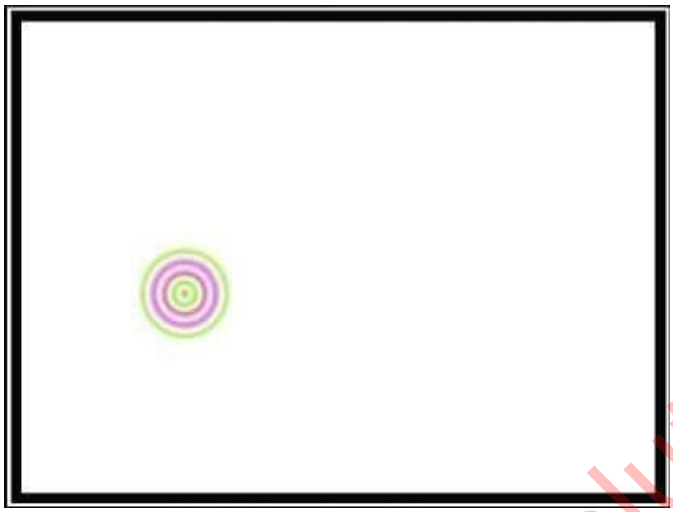
Functional Test

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 ≥ 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).

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

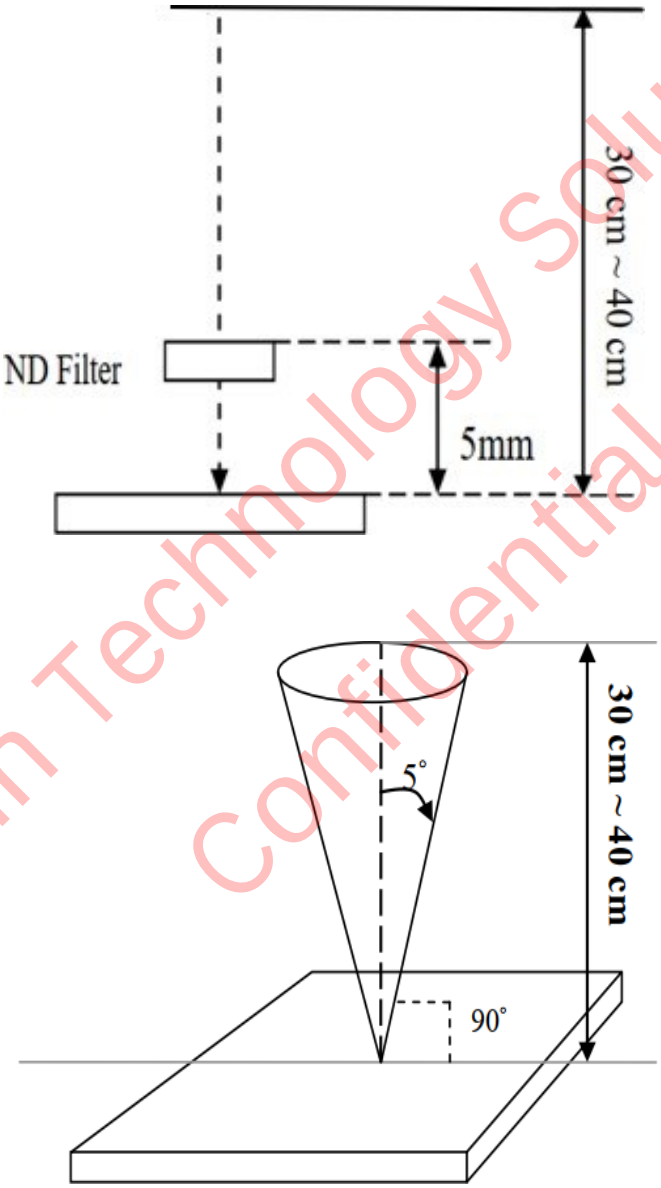
The inspection distance should be 35cm ± 5cm with a Fujifilm ND-LCD 5% filter approximately 5cm from the backlight surface.

Viewing angle: 90° ± 5°.

Room temperature: 23+/- 2°C

Humidity: 60 +/- 10%

Inspection Ambient Illumination: 300-700 LUX



Acceptance Criteria Table

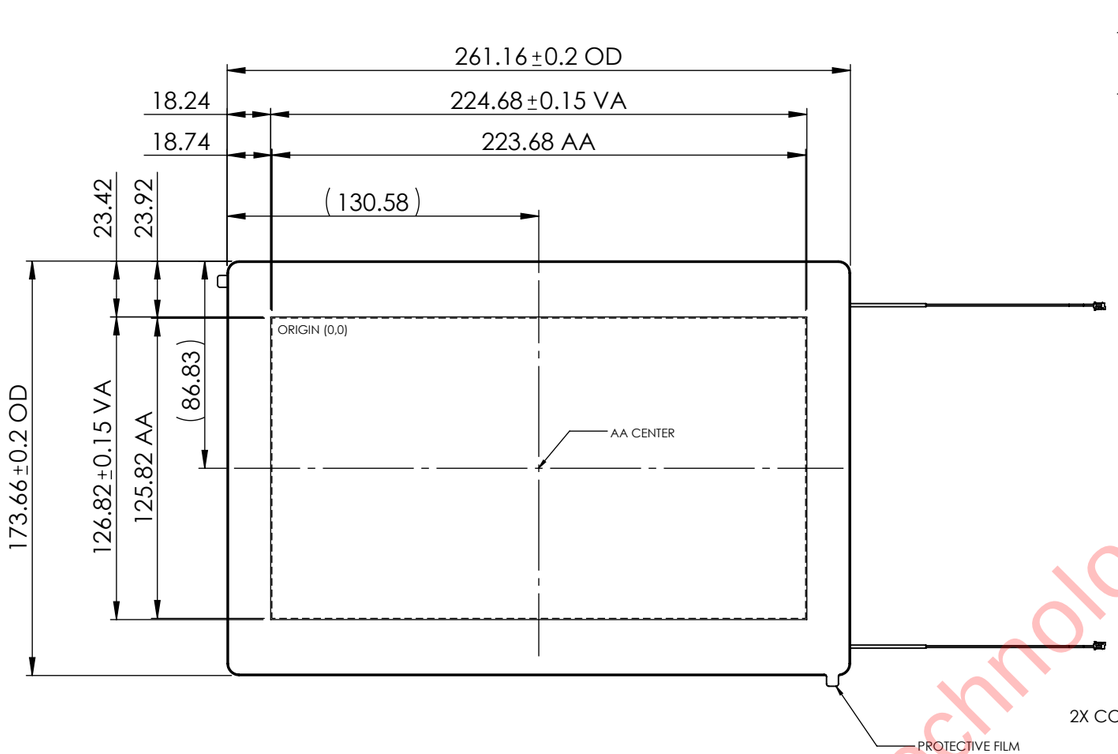
There should be no corrosion or cracking, or an uneven coating layer on the LCD surface, and there should be no sign of coagulation, flaking, cracking, or wear. The definition of minor defects and acceptance criteria are shown in the following table:

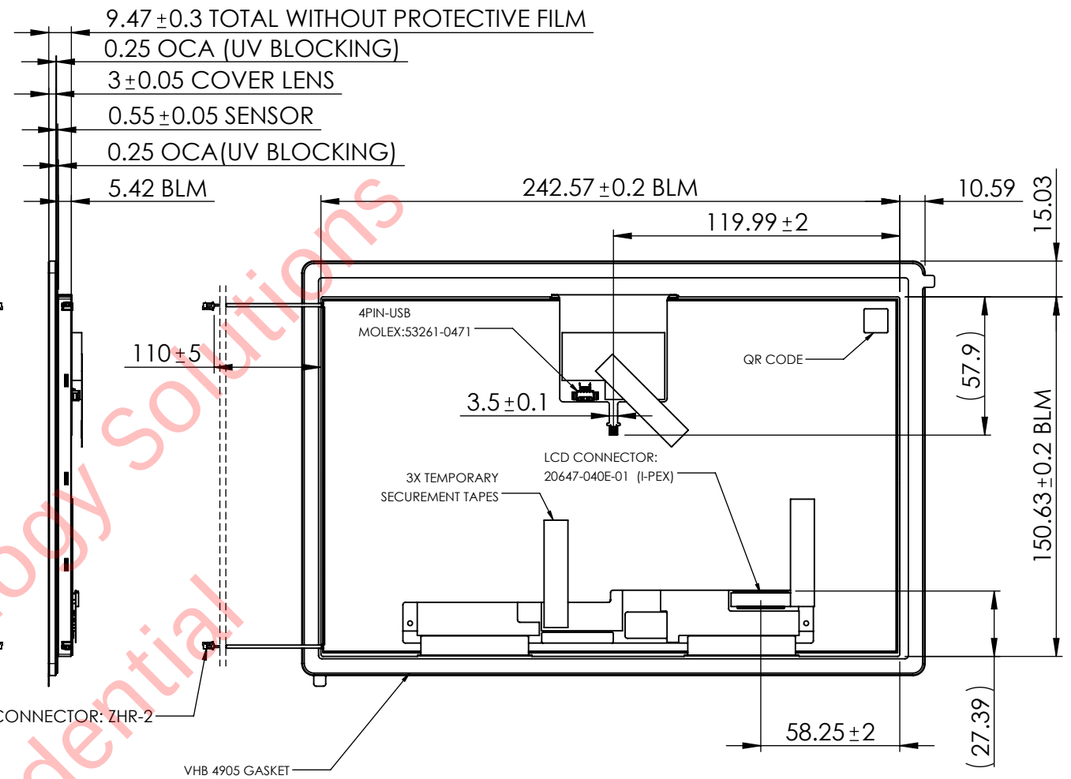
Item	Size	Unit	Acceptance Qty.
Unfelt scratch visible with backlight off.	W < 0.05	mm	Ignore
	W > 0.05 and < 0.10 L > 0.3 and < 3.0	mm	4
	W > 0.10 or L > 3.0	mm	none
	Visible with backlight on		none
Felt scratch	None allowed		
Dent visible with backlight off	D < 0.2	mm	Ignore
	D > 0.2 and < 0.5	mm	5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

DRW REV.	HW REV.	DESCRIPTION	DATE	APPROVED
A	0.1	INITIAL RELEASE	12/12/2024	JH
B	0.2	FOG UPDATED	3/3/2025	JH
C	0.2	PRODUCT PN UPGRADED	3/31/2025	JH
D	0.2	DRAWING NOTES/FORMATTING UPDATES; ADDED DIMENSIONS	4/16/2025	JH
E	0.2	NEW OCA MATERIAL FOR FOG-TP BOND	6/17/2025	JH
F	0.3	NEW OCA MATERIAL USED IN TP BOND (SENSOR-TO-CG)	7/7/2025	JH
G	0.3	CORRECTED AA CENTER DIMENSION	9/12/2025	JH





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: 1:2.5	SHEET 1 OF 1
DO NOT SCALE DRAWING	

DRAWN BY: LH — DATE: 9/12/2025
CHECKED BY: JH — DATE: 9/12/2025
MATERIAL: N/A
FINISH: N/A
COMMENTS: ALL DIMENSIONS ARE IN MILLIMETERS

LINCOLN TECHNOLOGY SOLUTIONS™

DESCRIPTION: 10.1" RUGGED DISPLAY W/ COVER LENS 1280*720

PART NO.	HW REV.	DRW REV.
LCD304-101CTL1ARNTT	0.3	G