111 Corning Rd, Suite 116 • Cary, NC 27518

LCD185-101CTL1ARNTT

10.1" Edge Lit High Bright Wide Gamut

w/PCAP

1920*1200

Table of Contents

Revision History

Document Revision

Date	Version #	Description
10/19/2021	R0.1	Preliminary Release
07/19/2022	R1.0	Production Release

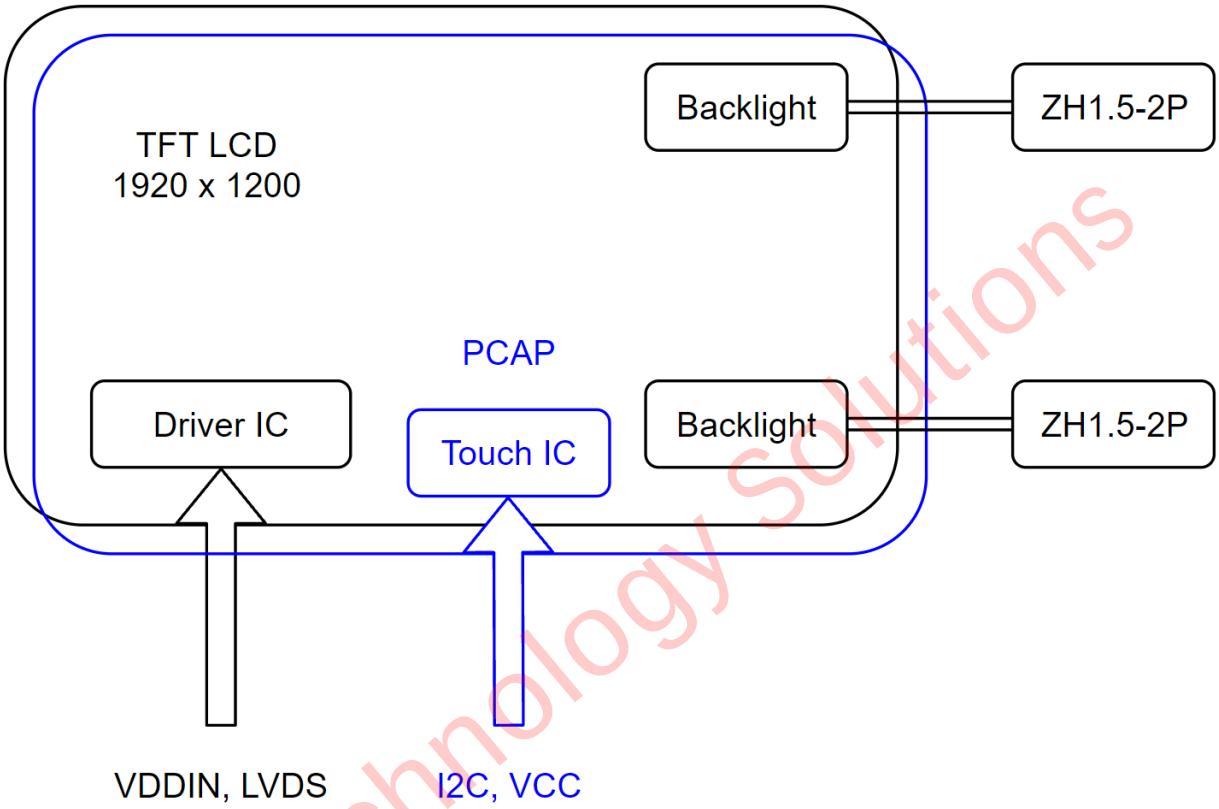
Hardware Revision

Date	Version #	Description
10/19/2021	R0.1	Preliminary Release
07/19/2022	R1.0	Production Release

General Specifications

Item	Specification	Unit
Outline Dimensions	246.16 (H) X 164.80 (V) X 7.15(D)	mm
Display Size	10.1	inches
Active Area	216.81 (H) X 135.50 (V)	mm
Sub Pixel Pitch	37.64 (H) X 112.92 (V)	um
Number of Dots	1920 (H) X 1200 (V)	-
LCD Type	TFT LCD 8bit 16.7M colors	-
Display mode	Normally Black	
Backlight Type	Edge Lit	-
Viewing Direction	Free	-
Touch Panel	PCAP GT928	-
Luminance	1000	cd/m^2
Interface	LVDS – Himax HX8290-B	-
Surface Treatment	AR	-
Operating	-20 to 70	°C

Block Diagram



Pin Out-LCD

The 10.1" LCD has a Hirose 45 position, 0.5mm pitch, MPN: FH34SRJ-45S-0.5SH(50).

Number	Symbol	I/O	Description
1	NC	-	Reserved (No Connection)
2	NC	-	Reserved (No Connection)
3	NC	-	Reserved (No Connection)
4	NC	-	Reserved (No Connection)
5	NC	-	No Connection
6	GND	P	Ground
7	ELV3P	I	Even LVDS Positive Data Signal +
8	ELV3N	I	Even LVDS Negative Data Signal -
9	GND	P	Ground
10	ELV2P	I	Even LVDS Positive Data Signal +
11	ELV2N	I	Even LVDS Negative Data Signal -
12	GND	P	Ground
13	ELVCLKP	I	Even LVDS Positive CLK Signal +
14	ELVCLKN	I	Even LVDS Negative CLK Signal -
15	GND	P	Ground
16	ELV1P	I	Even LVDS Positive Data Signal +
17	ELV1N	I	Even LVDS Negative Data Signal -
18	GND	P	Ground
19	ELV0P	I	Even LVDS Positive Data Signal +

20	ELV0N	I	Even LVDS Negative Data Signal -
21	GND	P	Ground
22	OLV3P	I	Odd LVDS Positive Data Signal +
23	OLV3N	I	Odd LVDS Negative Data Signal -
24	GND	P	Ground
25	OLV2P	I	Odd LVDS Positive Data Signal +
26	OLV2N	I	Odd LVDS Negative Data Signal -
27	GND	P	Ground
28	OLVCLKP	I	Odd LVDS Positive CLK Signal +
29	OLVCLKN	I	Odd LVDS Negative CLK Signal -
30	GND	P	Ground
31	OLV1P	I	Odd LVDS Positive Data Signal +
32	OLV1N	I	Odd LVDS Negative Data Signal -
33	GND	P	Ground
34	OLV0P	I	Odd LVDS Positive Data Signal +
35	OLV0N	I	Odd LVDS Negative Data Signal -
36	GND	P	Ground
37	NC	I/O	Reserved (No Connection)
38	NC	I	Reserved (No Connection)
39	NC	p	Reserved (No Connection)
40	NC	I	Reserved (No Connection)
41	VDDIN	P	Power Supply (3.3V)

42	VDDIN	P	Power Supply (3.3V)
43	VDDIN	P	Power Supply (3.3V)
44	VDDIN	P	Power Supply (3.3V)
45	VDDIN	P	Power Supply (3.3V)

Pin Out – PCAP

The PCAP tail is 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	RSTN	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

Absolute Max Ratings – LCD

Item	Symbol	Value	Unit
Power Supply Voltage	VDDIN	-0.3 – 3.6	V
Operating Temperature	Topr	-20 to 70	°C
Storage Temperature	Tstg	-30 to 80	°C
Operating Humidity	Hop	10 to 90	%RH

Absolute Max Ratings – PCAP

Item	Symbol	Value	Unit
Operating Voltage	VCC	-0.3 – 3.47	V
I/O Supply Voltage	IOVCC	-0.3 – 2.1	V

Electrical Characteristics - LCD

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Power Supply Voltage	VDDIN	3.0	3.3	3.6	V	-
Power Supply Current	IDD	-	300	360	mA	Note 1
Power Consumption	PLCD	-	1	1.2	W	
Rush Current	IRUSH	-	-	3.0	A	Note 2
Input Voltage	Vih	2.7	-	3.3	V	-
	Vil	0	-	0.5	V	-
Output Voltage	Voh	2.7	-	3.3	V	-
	Vol	0	-	0.5	V	-

Notes:

1. The current draw and power consumption specified is for VDDIN = 3.3V, Frame rate Fv = 60Hz and Clock frequency = 80MHz.
2. The duration of rush current is about 2ms and rising time of Power input is 1ms(min).

Electrical Characteristics – PCAP

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Power Supply Voltage	VCC	2.8		3.3	V	-
I/O Supply Voltage	IOVCC	-	1.8	1.95	V	-
Power Supply Current	ICC	-	13.37	-	mA	Ta = 25 °C
Input Voltage	Vih	0.75*IOVCC	-	IOVCC+0.3	V	-
	Vil	-0.3	-	0.25*IOVCC	V	-
Output Voltage	Voh	0.85*IOVCC	-	-	V	-
	Vol	-	-	0.15*IOVCC	V	-

Backlight Specifications

This design has 2 LED rails to achieve maximum brightness. JST ZH series was chosen for ease of integration. The backlight wiring has been pinned in to a 2 position, 1.5mm 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., 143mA per backlight connector is required for a total of 285mA (typical) at 1000nits.

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Voltage	Vf		28		V	
Supply Current	If	-	285	-	mA	1000 NITS

Backlight – ZHR-2 pinout

Number	Name	I/O	Description
1	LEDA	P	BL Power positive
2	LEDK	P	BL Power negative

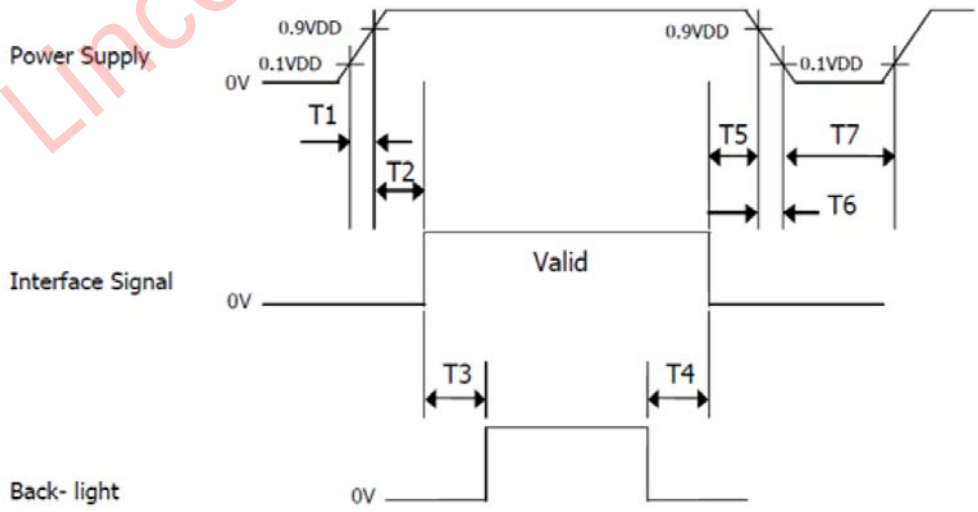
Timing Specifications - LCD

Refer to HX8290-B datasheet.

LVDS Timing

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK Frequency	Fdclk	74.5	77.56	85	MHz
Horizontal display area	Thd		960		DCLK
HSYNC period time	Th	989	1040	1248	DCLK
Horizontal Blank	THB	29	80	288	DCLK
HSYNC pulse width	Thp	2	10	255	DCLK
HSYNC back porch	thbp	3	6	255	DCLK
HSYNC Front porch	thfp	24	64	260	DCLK
Vertical display area	Tvd		1200		H
VSYNC period time	Tv	1243	1243	1560	H
Vertical Blank	TVB	43	43	360	H
VSYNC Pluse width	Tvp	4	4	20	H
VSYNC back porch	Tvbp	20	20	255	H
VSYNC front porch	Tvfp	19	19	260	H
Frequency	fV	-	60	-	Hz

Power ON/OFF Sequence

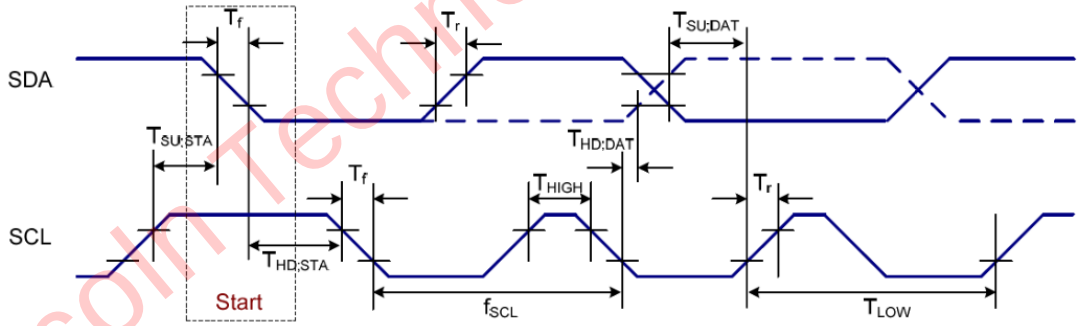


Parameter	Values			Units
	Min	Typ	Max	
T1	0	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	500	-	-	ms
T5	0	-	50	ms
T6	0	-	10	ms
T7	500	-	-	ms

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

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

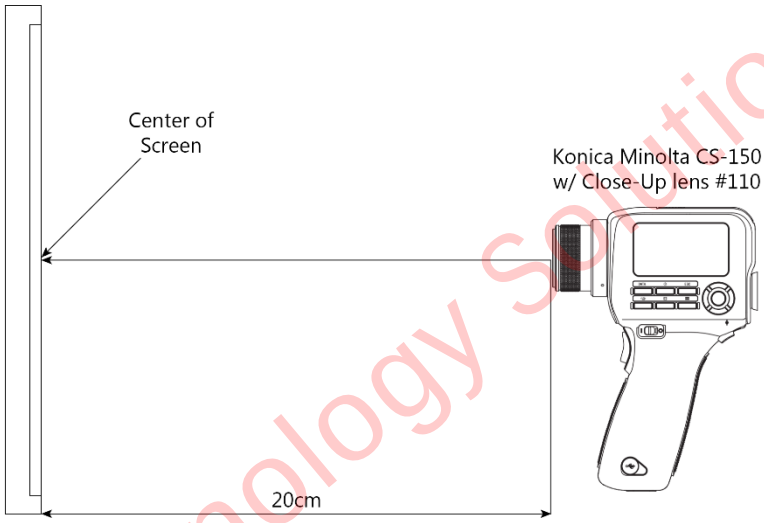
Optical Characteristics

All measurements taken after minimum runtime of 25 minutes.

Item		Symbol	Conditions	Specification			Unit	Note
				Min	Typ	Max		
Response Time		Tr Tf	Ta = 25°C	-	30	35	ms	(1)(4)
Contrast Ratio		CR	Normal Viewing Angle	700	900	-	-	(1)(3)(5)
Viewing Angle	Hor.	X-	CR>10	70	80	-	Deg	(3)(5)
		X+		70	80	-	Deg	
	Ver.	Y+		70	80	-	Deg	
		Y-		70	80	-	Deg	
Chromaticity	Red	RX	Ta = 25 °C	-	.673	-	-	
		Ry		-	.320	-	-	
	Green	GX		-	.208	-	-	
		Gy		-	.738	-	-	
	Blue	BX		-	.148	-	-	
		By		-	.057	-	-	
	White	WX		-	.288	-	-	
		Wy		-	.355	-	-	
Luminance		L	Ta = 25 °C	-	1000	-	cd/m2	(1)
Color Gamut Ratio DCI-P3				-	110		%	
Color Gamut Coverage DCI-P3				-	98	-	%	
Uniformity		U		75	80	-	%	(2)

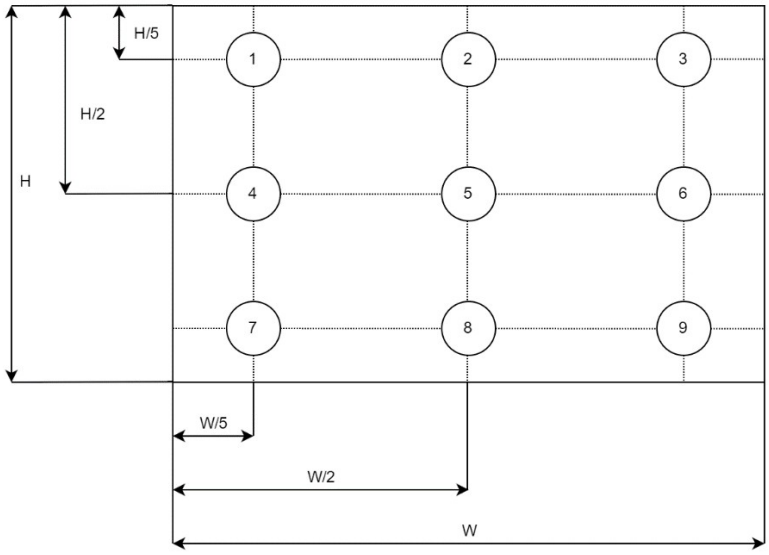
Note 1: Measurement setup

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.



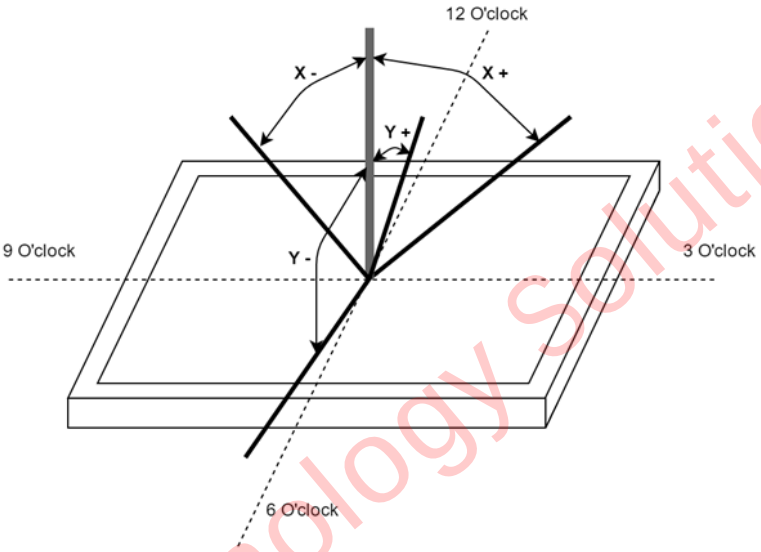
Note 2: Brightness Uniformity

Brightness uniformity = (Minimum Luminance of 9 points / Max Luminance of 9 points) * 100



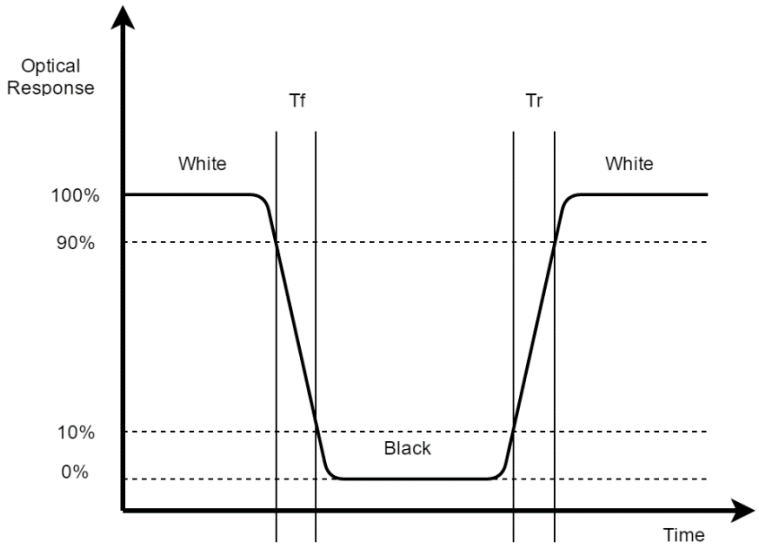
Note 3: Viewing Angle

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



Note 4: Response Time

Definition of response time as follows below.



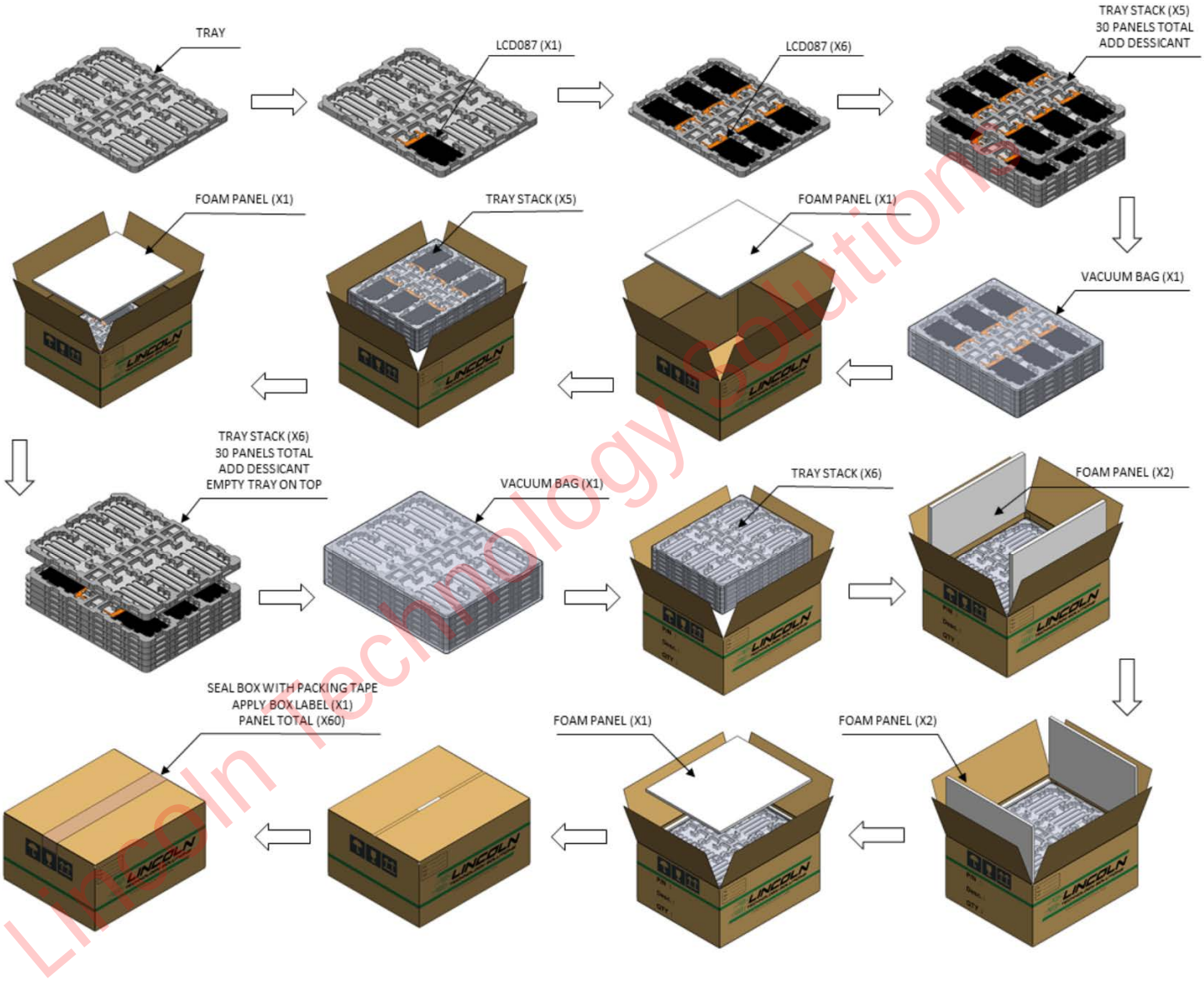
Note 5: Contrast Ratio

Definition of Contrast Ratio is as follows.

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

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

Packaging

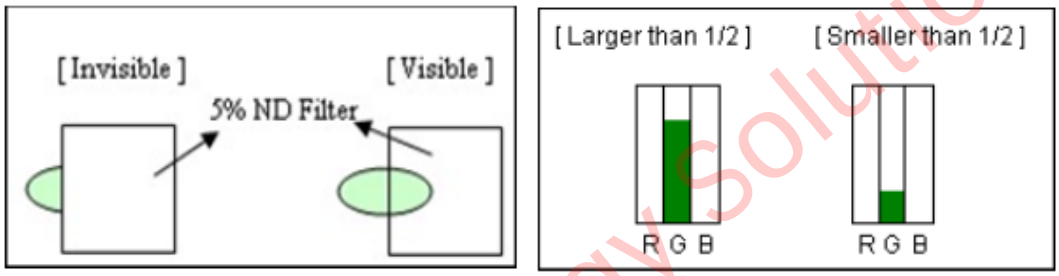


Quality & Inspection Criteria

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.

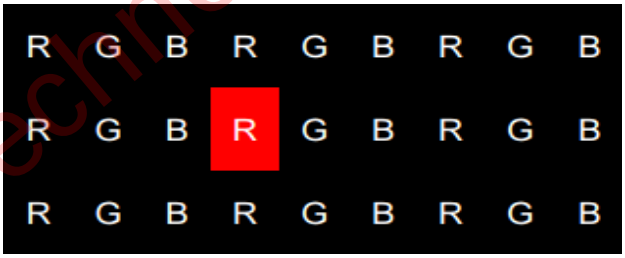


"No dot defect" (=ignored)

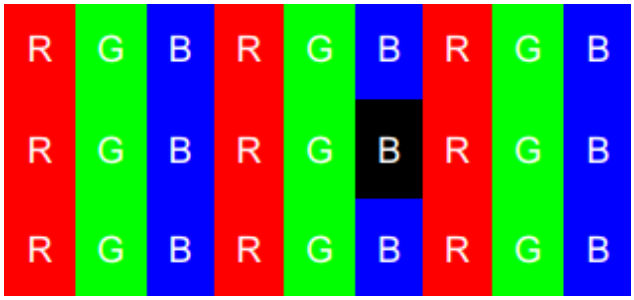
"1 dot defect" (=counted)

"1 dot defect" (=counted)

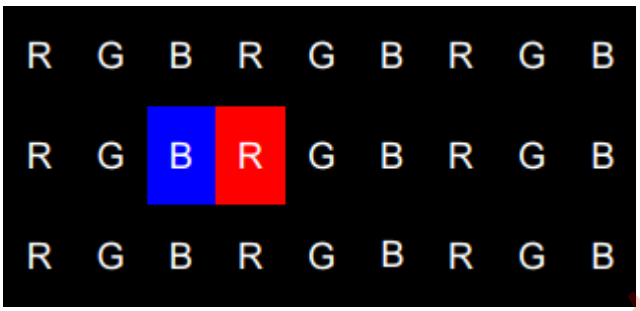
"No dot defect" (=ignored)



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.

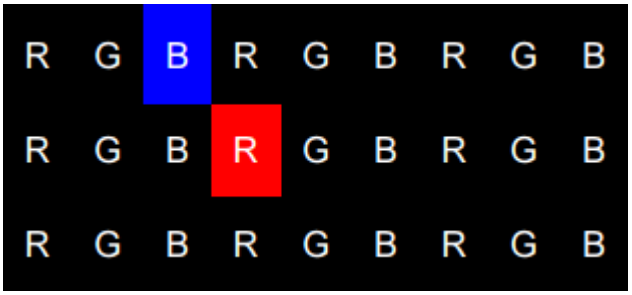


Two adjacent dots (horizontal direction): Use the bright dot illustration as an example to demonstrate two horizontal consecutive dots.



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.

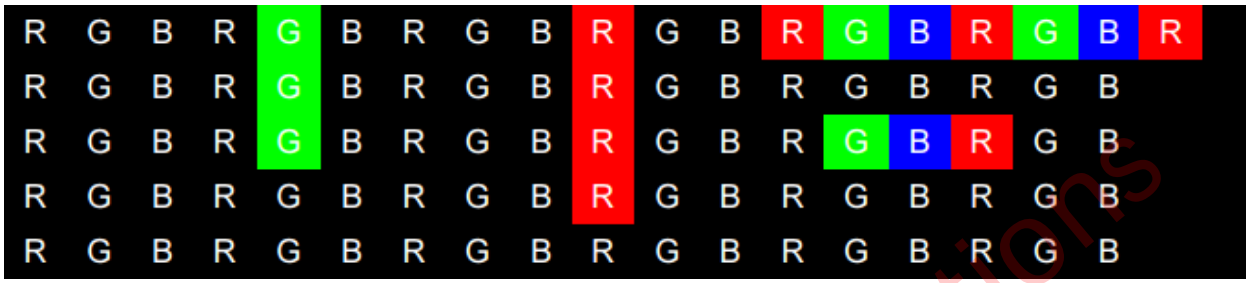
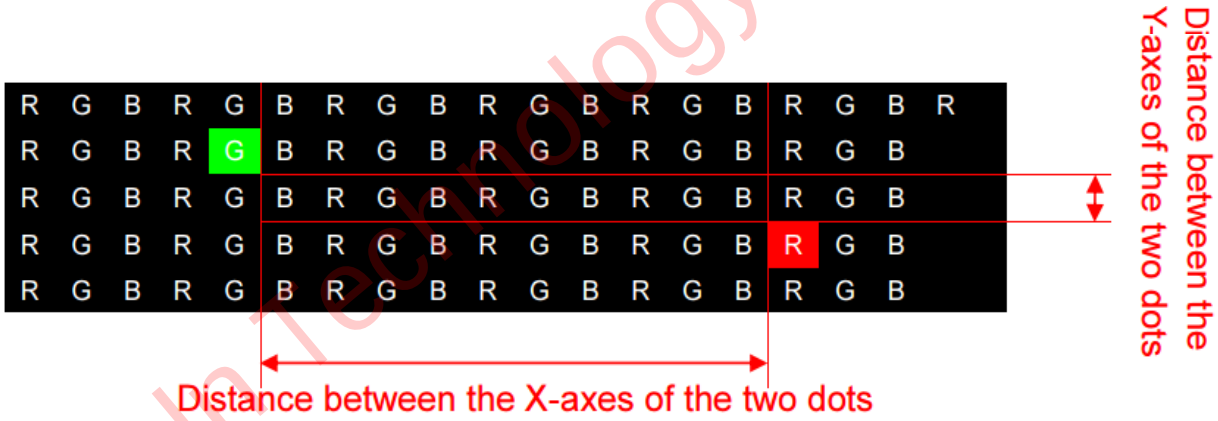


Illustration of spacing between two dots: (Distance is the relative distance between the X-axes of the two dots or the relative distance between the Y-axes of the two dots, whichever is larger)



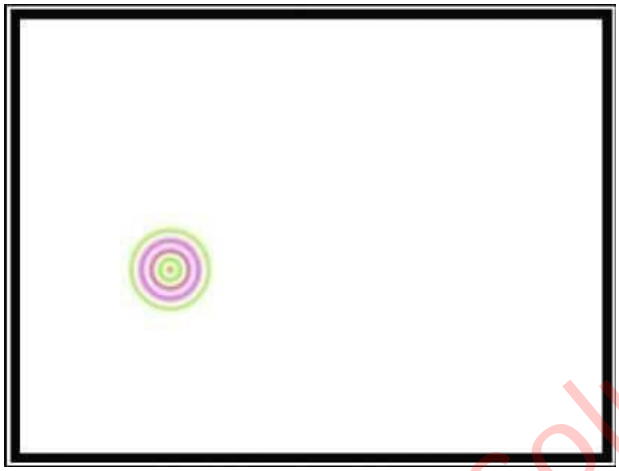
Functional Test

The LCD 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.

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).

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

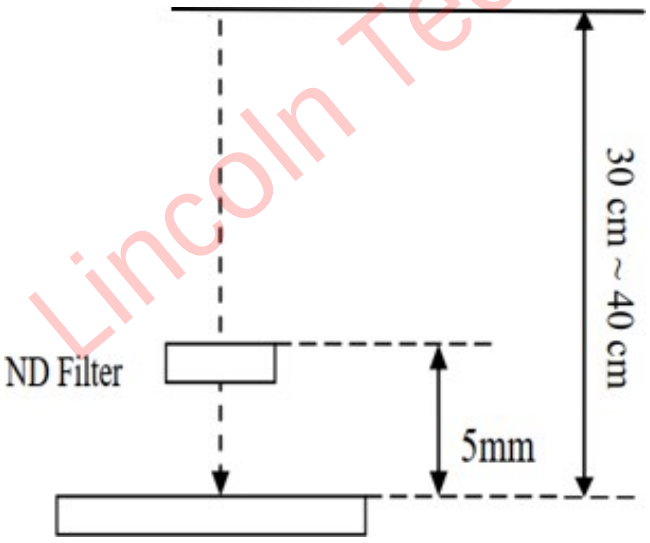
Inspection distance should be 35cm ± 5cm with a FujiFilm ND-LCD 5% filter approximately 5cm from the backlight surface.

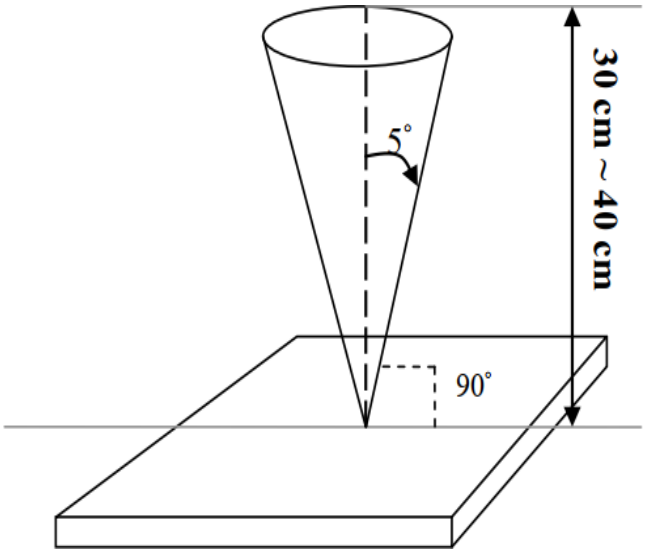
Viewing angle: 90° ± 5°.

Room temperature: 23+/- 2°C

Humidity: 60 +/- 10%

Inspection Ambient Illumination: 300-700 LUX





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	Size	Unit	Acceptance qty.
Unfelt scratch visible with backlight off.	W < 0.05	mm	Ignore
	W > .05 and < .10 L > .3 and < 3.0	mm	4
	W > .10 or L > 3.0	mm	none
	Visible with backlight on		none
Felt scratch	None allowed		
Dent visible with backlight off	D < .2	mm	Ignore
	D > .2 and < .5	mm	5
	Spacing between defects must be > 30mm		
	D > .5	mm	none
	Visible with backlight on		none
Bubble visible with backlight off	D < .2	mm	Ignore
	D > .2 and < .5	mm	5
	D > .5	mm	none
	Visible with backlight on		none
	W < .05	mm	Ignore

Item	Size	Unit	Acceptance qty.
Foreign material (line shape) visible with backlight on			
	W > .05 and < .10 L > .3 and < 2.0	mm	4
	W > .10 or L > 2.0	mm	none
Foreign material (dot shape) visible with backlight on	D < .2	mm	Ignore
	D> .2 and < .5	mm	5
	D > .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: Drawing

REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	A	INITIAL ISSUE	2021/10/21	QIN

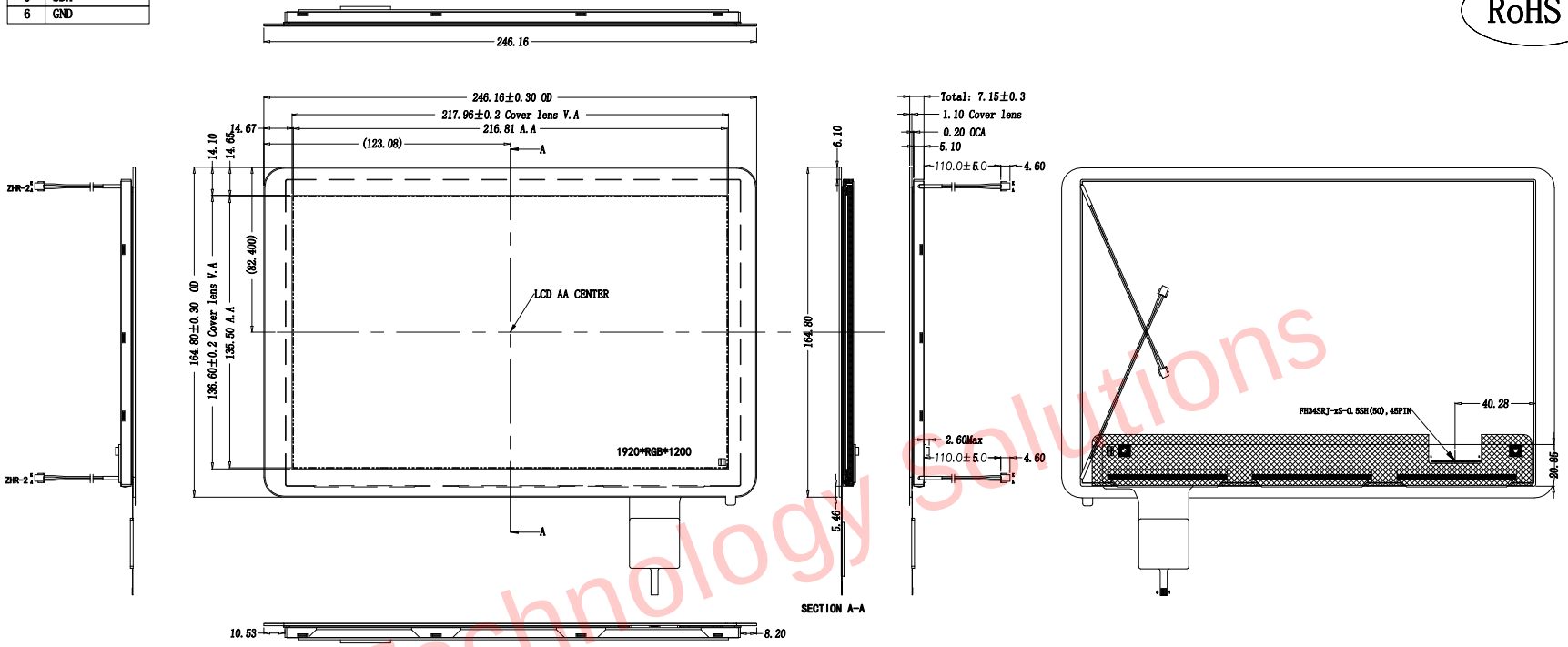
45 Pin Map

PIN:	SYMBLE
1	NC
2	NC
3	NC
4	NC
5	NC
6	GND
7	ELV3P
8	ELV3N
9	GND
10	ELV2P
11	ELV2N
12	GND
13	ELVCLKP
14	ELVCLKN
15	GND
16	ELV1P
17	ELV1N
18	GND
19	ELV0P
20	ELV0N
21	GND
22	OLV3P
23	OLV3N
24	GND
25	OLV2P
26	OLV2N
27	GND
28	OLVCLKP
29	OLVCLKN
30	GND
31	OLV1P
32	OLV1N
33	GND
34	OLV0P
35	OLV0N
36	GND
37	I2C_SDA
38	I2C_SCL
39	VDD_OTP
40	EEPEN
41	VDDIN
42	VDDIN
43	VDDIN
44	VDDIN
45	VDDIN

CTP ASSIGNMENT:

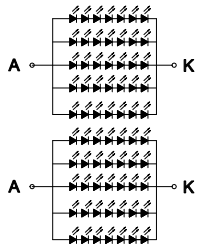
PIN	SYMBLE
1	VCC
2	RST
3	INT
4	SCL
5	SDA
6	GND

RoHS



Note

1. Display Type: 10.1" TFT LCD, Wide Color Gamut Solution
2. Viewing Angle: All
3. LCD Luminance (Center) 1000nits (Typ.)
   VF: 28V. IF = 143mA * 2g
   Uniformity 80% (min.) LCD luminance center
4. LCD Chromaticity (White) : X=031+/- 0.03; Y=0.33+/-0.33:
5. Operating Temp: -20C - +70C
   Storage Temp: -30C - +80C
6. All the materials are ROHS compliant



LED circuit: 7S5P*2 rails

DRAWN BY: JY	DATE: 2021/10/21
CHECKED BY: QIN	DATE: 2021/10/21
MATERIAL: N/A	
FINISH: N/A	
COMMENTS: ALL DIMENSIONS ARE IN MILLIMETRES.GENERAL TOLERANCES ARE ¡À 0.3MM.	
SCALE: 1:3	SHEET 1 OF 1
DO NOT SCALE DRAWING	

LINCOLN TECHNOLOGY SOLUTIONS

DESCRIPTION: 10.1" HBWG LCD

PART NO. LCD185-CTL1ARNTTR1.0 REV. A