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TFT | OLED | CHARACTER | GRAPHIC | UWVD | SEGMENT | CUSTOM

TFT Display Module

Part Number

E101RA-HS500-C

Overview:

- 10.1-inch TFT (159.00x244.60mm)
- 1200x1920 Pixels
- HDMI Interface
- Special Temperature Range
- All Viewing Angles
- IPS, Transmissive
- Capacitive Touch Panel
- 220 NITS
- TFT IC: NT51021 CTP IC: ILI2511
- RoHS Compliant

Description

This is a color active matrix TFT (Thin Film Transistor) LCD (Liquid Crystal Display) that uses amorphous silicon TFT as a switching device. This model is composed of a transmissive type TFT-LCD Panel, driver circuit, capacitive touch panel, backlight unit, and HDMI adapter board. The resolution of the 10.1" TFT-LCD contains 1200x1920 pixels and can display up to 16.7M colors.

Features

Input Voltage: 12V
TFT Interface: HDMI
CTP Interface: Micro USB

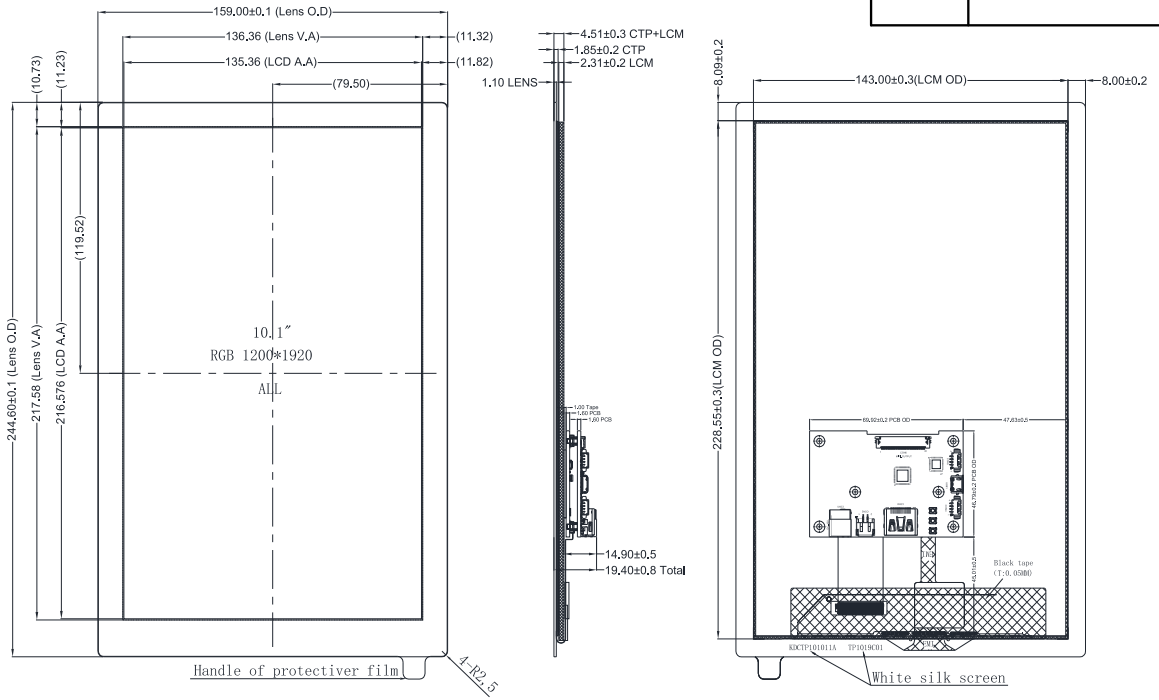
General Information Items	Specification	Unit	Note
	Main Panel		
TFT Display Area (AA)	135.36(H) x 216.58(V) (10.1 inch)	mm	--
CTP View Area	136.36(H) x 217.58(V)	mm	--
Driver Element	TFT active matrix	--	--
Display Colors	16.7M	colors	--
Number of Pixels	1200(RGB)x1920	dots	--
TFT Pixel Arrangement	RGB vertical stripe	--	--
Pixel Pitch	0.1128 (H) x 0.1128 (V)	mm	--
Viewing Angle	ALL	o'clock	--
TFT Controller IC	NT51021	--	--
CTP Driver IC	ILI2511	--	--
Display Mode	Transmissive/Normally Black	--	--
Touch Points	Multiple point	--	--
Operating Temperature	-10 to +50	°C	--
Storage Temperature	-20 to +60	°C	--

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	159.00	--	mm	--
	Vertical (V)	--	244.60	--	mm	--
	Depth (D)	--	--	20.20	mm	--
Weight		--	379	--	g	Approximate

1. Outline Dimensions

Rev.	Description	Date
1.0	First	2022.12.30
2.0	Update	2023.02.02



CON 1:
DC-044/12V

NO	PIN
1	DC_IN/12V
2	GND
3	GND

CON 2:
BKL/Molex-53261-0671

NO	PIN
1	GND
2	GND
3	BL_ADJ/NC
4	BL_EN/NC
5	VDD_12V
6	VDD_12V

CON 3:
S2B-PH-SM4-TB

NO	PIN
1	+12V
4	GND

CON 4:
HDMI IN (Type A)

NO	PIN	NO	PIN
1	RX_D2+	11	GND
2	GND	12	RX_CLK-
3	RX_D2-	13	CEC
4	RX_D1+	14	RESERVED
5	GND	15	HDMI_SCL
6	RX_D1-	16	HDMI_SDA
7	RX_D0+	17	GND
8	GND	18	HDMI_VCC
9	RX_D0-	19	HDMI_HPD
10	RX_CLK+		

CON 6:
Molex-53261-0471

NO	PIN
1	VBUS_5V
2	USB_DN
3	USB_DP
4	GND

CON 7:
Molex-53261-0471

NO	PIN
1	OFF/ON
2	BLK-
3	BLK+
4	GND

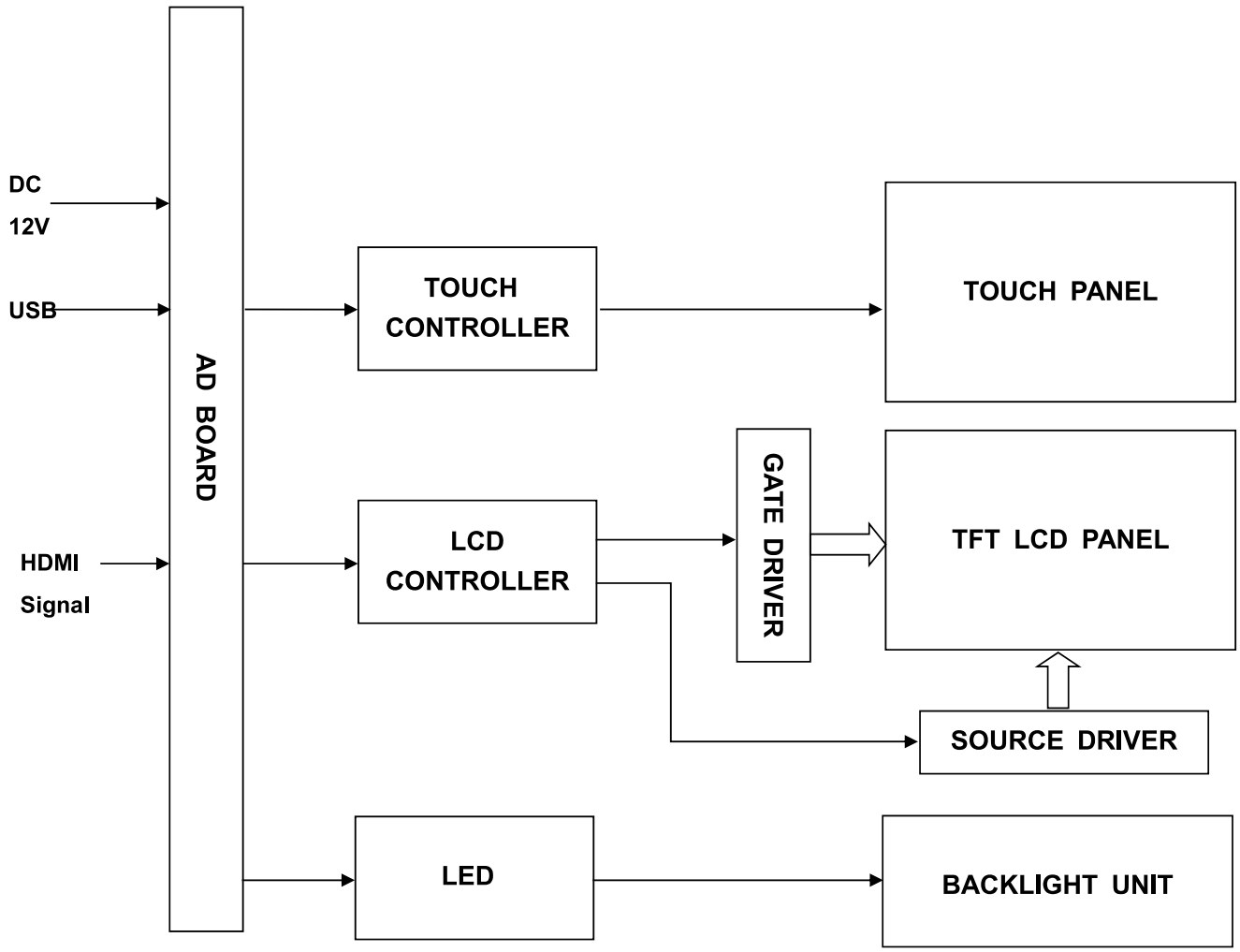
USB1:
Micro USB

NO	PIN
1	VBUS_5V
2	USB_DN
3	USB_DP
4	NC
5	GND

NOTES:
1. DISPLAY TYPE: 10.1" TFT-LCD
2. DISPLAY MODE: IPS/NORMALLY BLACK
3. LCM DRIVER IC: NT51021
   CTP DRIVER IC: ILI2511
4. SUPPLY VOLTAGE: 12V/2A (Typ.)
5. OPERATING TEMPERATURE: -10°C TO +50°C
6. STORAGE TEMPERATURE: -20°C TO +60°C
7. VIEWING DIRECTION: ALL
8. BACKLIGHT: 32 LED WHITE, VF = 24V, IF = 80mA
9. ROHS COMPLIANT.

Model Name: E101RA-HS500-C			
General Tol: ±0.3			
Approvals	Date	Drawing No.:	Scale:
DWN:			
CHK:		Size:	Unit: mm / Page: 1/1
APP:			

2. Block Diagram



3. Terminal Pin Assignment

3.1 Power Input Pin Assignment

CON1(DC-044 Socket)

NO.	Symbol	Description	I/O
1	DC_IN	Power supply (DC 12V).	P
2	GND	Ground.	P
3	GND	Ground.	P

Extension CON3(JST:S2B-PH-SM4-TB)

NO.	Symbol	Description	I/O
1	+12V	Power supply (DC 12V).	P
2	GND	Ground.	P

3.2 Touch Input Pin Assignment

USB1(Micro USB)

NO.	Symbol	Description	I/O
1	VBUS_5V	Supply voltage (5V).	P
2	USB_DN	USB- signal.	I/O
3	USB_DP	USB+ signal.	I/O
4	NC	No connection.	--
5	GND	Ground.	P

Extension CON6(Molex:53261-0471)

NO.	Symbol	Description	I/O
1	VBUS_5V	Supply voltage (5V).	P
2	USB_DN	USB- signal.	I/O
3	USB_DP	USB+ signal.	I/O
4	GND	Ground.	P

3.3 HDMI Pin Assignment

CON4: The type of HDMI connector is a type A.

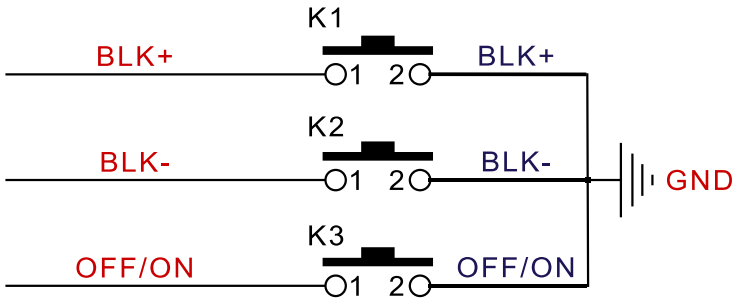
NO.	Symbol	Description	I/O
1	RX_D2+	HDMI receiver channel 2 positive analog input.	I/O
2	GND	Ground.	P
3	RX_D2-	HDMI receiver channel 2 negative analog input.	I/O
4	RX_D1+	HDMI receiver channel 1 positive analog input.	I/O
5	GND	Ground.	P
6	RX_D1-	HDMI receiver channel 1 negative analog input.	I/O
7	RX_D0+	HDMI receiver channel 0 positive analog input.	I/O
8	GND	Ground.	P
9	RX_D0-	HDMI receiver channel 0 negative analog input.	I/O
10	RX_CLK+	HDMI receiver clock positive analog input.	I
11	GND	Ground.	P
12	RX_CLK-	HDMI receiver clock negative analog input.	I
13	CEC	No connection.	--
14	RESERVED	No connection.	--
15	HDMI_SCL	HDMI receiver DDC data channel.	I
16	HDMI_SDA	HDMI receiver DDC clock channel.	I/O
17	GND	Ground.	P
18	HDMI_VCC	HDMI supply voltage (5.0V).	P
19	HDMI_HPD	HDMI receiver hot plug detect output.	O

I: Input, O: Output, P: Power

3.4 Backlight Key Output Pin Assignment

CON7(Molex-53261-0471)

NO.	Symbol	Description	I/O
1	OFF/ON	Turn off or turn on backlight.	I
2	BLK-	Reduce brightness of backlight.	I
3	BLK+	Increase brightness of backlight. Note: The brightness is configured for maximum after power on.	I
4	GND	Ground.	P



Key circuit diagram

3.5 Extension Backlight Output Pin Assignment

CON2(Molex-53261-0671)

NO.	Symbol	Description	I/O
1	GND	Ground.	P
2	GND	Ground.	P
3	BL_ADJ	PWM signal output.	O
4	BL_EN	Enable signal.	O
5	12V	Power supply.	P
6	12V	Power supply.	P

4. LCD Optical Characteristics

4.1 Optical Specifications

Item		Symbol	Condition	Min	Typ.	Max	Unit	Note
Color Gamut		S(%)		--	80	--	%	(5)
Contrast Ratio		CR	θ=0 Normal viewing angle	600	800	--	%	(2)
Response Time	Rising	TR		--	25	50	ms	(4)
	Falling	TF						
Color Filter Chromaticity	White	WX		0.2460	0.2860	0.3260		(5)(6)
		WY		0.2810	0.3210	0.3610		
	Red	RX		0.5790	0.6190	0.6590		
		RY		0.2890	0.3290	0.3690		
	Green	GX		0.2610	0.3010	0.3410		
		GY		0.5600	0.6000	0.6400		
	Blue	BX		0.1100	0.1500	0.1900		
		BY		0.0190	0.0590	0.0990		
Viewing Angle	Hor.	ΘL	CR≥10	--	85	--	degree	(1)(6)
		ΘR		--	85	--		
	Ver.	ΘT		--	85	--		
		ΘB		--	85	--		
Option View Direction		ALL						(1)

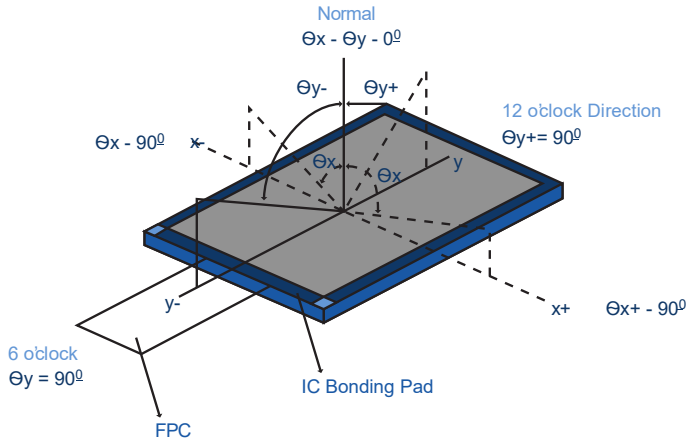
Measuring Conditions:

1. Dark Room
2. Ambient Temperature of 25±2°C
3. 15 Minute Warm up

Optical Specification Reference Notes:

(1) Definition of Viewing Angle:

The viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3,9 o'clock direction and the vertical or 6,12 o'clock direction with respect to the optical axis which is normal to the LCD surface.



(2) Definition of Contrast Ratio:

Measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

$$Cr = \frac{Lw}{Ld}$$

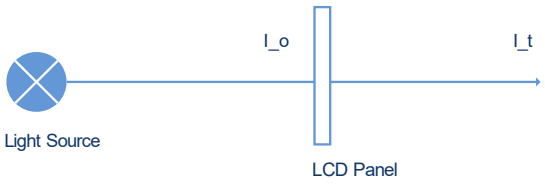
(3) Definition of Transmittance (T%):

The transmittance of the panel including the polarizers is measured with electrical driving. The equation for transmittance Tr is:

$$Tr = \frac{It}{Io} \times 100\%$$

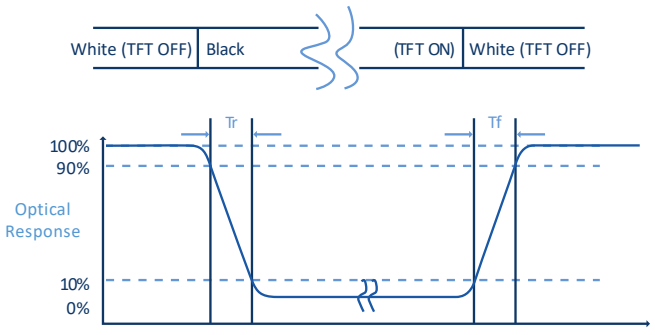
Io = the brightness of the light source.

It = the brightness after panel transmission



(4) Definition of Response Time (T_R, T_F):

The rise time 'Tr' is defined as the time for luminance to change from 90%to 10% as a result of a change of the electrical condition. The fall time 'Tf' is defined as the time for luminance to change from 10% to 90% as a result of a change of the electrical condition.



(5) Definition of Color Gamut:

Measuring machine CFT-01. NTSC's Primaries: R(x,y,Y),G(x,y,Y), B(x,y,Y). FPM520 of Westar Display Technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics. The color chromaticity shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

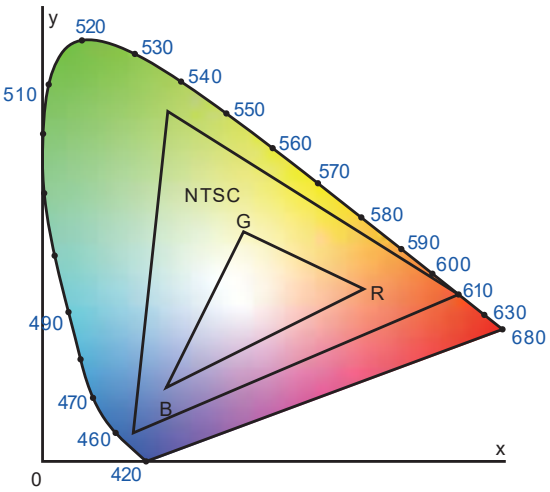
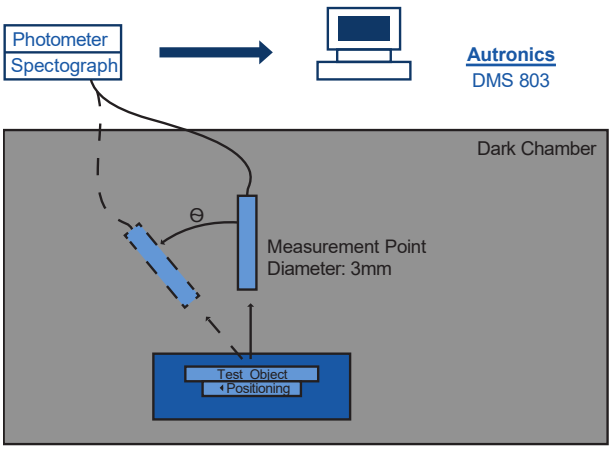


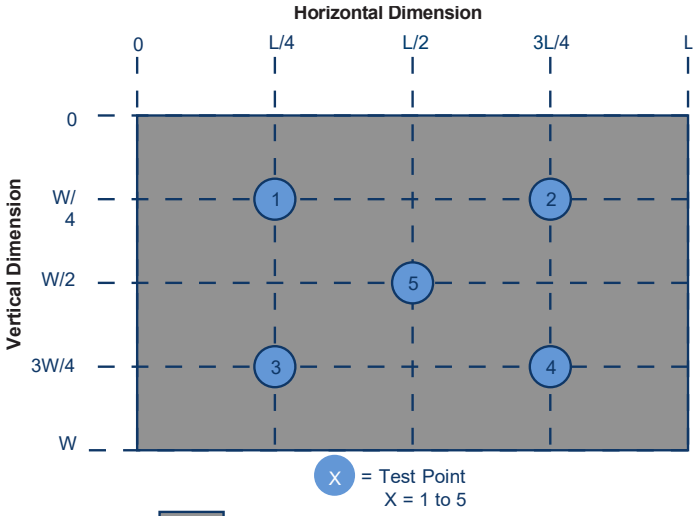
Fig. 1931 CIE Chromacity Diagram

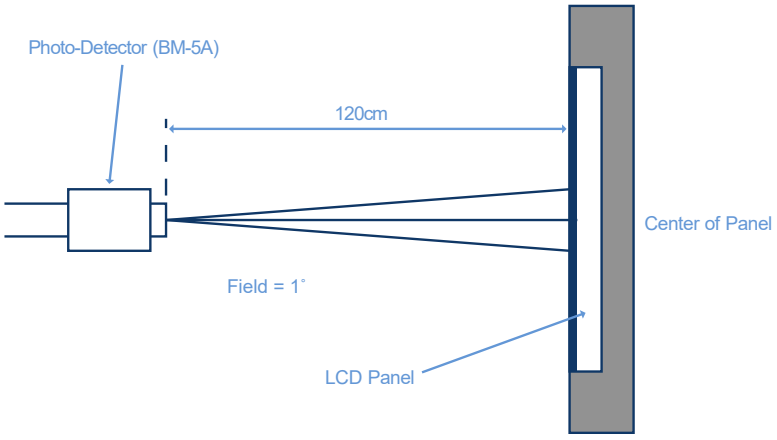
Color Gamut: $S = \frac{\text{Area of RGB Triangle}}{\text{Area of NTSC Triangle}} \times 100\%$

(6) Definition of Optical Measurement Setup:

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting backlight for 20 minutes.







5. TFT Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25°C, VSS=0V)

Characteristics	Symbol	Min	Max	Unit
Power Supply Voltage	DC_IN	-0.5	16	V
Operating Temperature	TOP	-10	+50	°C
Storage Temperature	TST	-20	+60	°C

NOTE: If the absolute maximum rating of the above parameters is exceeded, even momentarily, the quality of the product may be degraded. Absolute maximum ratings specify the values which the product may be physically damaged if exceeded. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min	Typ.	Max	Unit	Note
Power Supply Voltage	DC_IN	9	12	16	V	--
Normal Mode Current Consumption	I_{DCIN}	--	220	--	mA	--
Level Input Voltage	V_{IH}	0.7*VDDIO	--	VDDIO	V	--
	V_{IL}	GND	--	0.3*VDDIO	V	--
Level Output Voltage	V_{OH}	0.8*VDDIO	--	VDDIO	V	--
	V_{OL}	GND	--	0.2*VDDIO	V	--

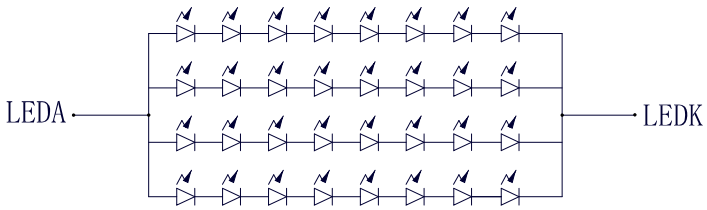
5.3 LED Backlight Characteristics

The backlight system is edge lighting type with 32 LED Chips

Item	Symbol	Min	Typ.	Max	Unit	Note
Forward Current	I_F	60	80	--	mA	--
Forward Voltage	V_F	--	24	--	V	--
LCM Luminance	L_V	180	220	--	cd/m2	(3)
LED Lifetime	Hr	--	50000	--	hour	(1)(2)
Uniformity	Avg	80	--	--	%	(3)

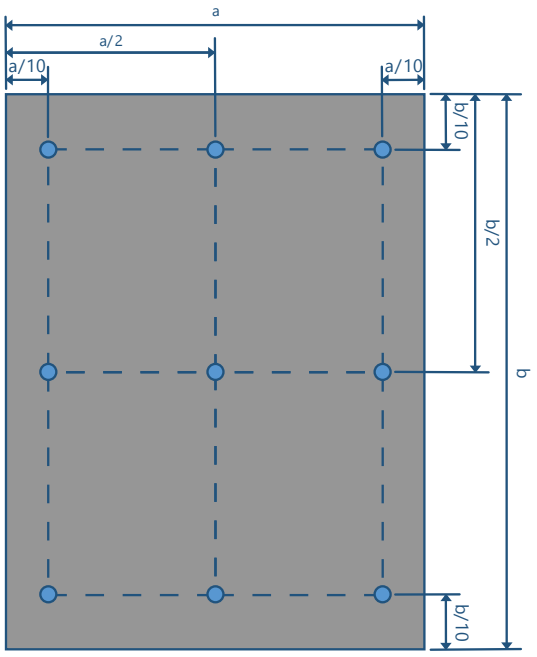
Note 1: *LED lifetime (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25 ±3°C, typical IL value indicated in the above table until the brightness becomes less than 50%.*

Note 2: *The "LED lifetime" is defined as the module brightness decrease to 50% original brightness at Ta=25° C and IF = 80mA. The LED lifetime could be decreased if operating IF is larger than 80mA. The constant current driving method is suggested.*



BL CIRCUIT DIAGRAM

Note 3: Luminance Uniformity of these 9 points is defined as below:



$$Luminance = \frac{(Total\ Luminance\ of\ 9\ Points)}{9}$$

$$Uniformity = \frac{Minimum\ Luminance\ in\ 9\ Points\ (1\text{-}9)}{Maximum\ Luminance\ in\ 9\ Points\ (1\text{-}9)}$$

6. TFT AC Characteristics

For more information on controller IC NT51021, please see the following link:
https://focuslcds.com/wp-content/uploads/Drivers/NT51021.pdf

7. CTP Electrical Characteristics

7.1 Absolute Maximum Rating

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	VDD	3.0	3.6	V	
Operating Temperature	T_{OP}	-40	+85	°C	
Storage Temperature	T_{ST}	-40	+85	°C	

7.2 I2C Timing

For I2C timing diagrams and tables, see page 13 of the data sheet for touch panel IC ILI2511. The data sheet for ILI2511 can be found here: *https://focuslcds.com/wp-content/uploads/Drivers/ILI2511.pdf*

7.5 Power-On Timing

For the power on timing diagram, see the first diagram on page 14 of the data sheet for touch panel IC ILI2511. The data sheet for ILI2511 can be found here: *https://focuslcds.com/wp-content/uploads/Drivers/ILI2511.pdf*

7.6 I2C DC Characteristics

For I2C DC Characteristics, see table 5-4 on page 11 of the data sheet for touch panel IC ILI2511. The data sheet for ILI2511 can be found here:

https://focuslcds.com/wp-content/uploads/Drivers/ILI2511.pdf

7.7 USB DC Characteristics

For USB DC Characteristics, see table 5-5 on page 12 of the data sheet for touch panel IC ILI2511. The data sheet for ILI2511 can be found here:

https://focuslcds.com/wp-content/uploads/Drivers/ILI2511.pdf

7.8 I2C AC Characteristics

For I2C AC Characteristics, see diagram in section 5.4 and table 5-7 on page 13 of the data sheet for touch panel IC ILI2511. The data sheet for ILI2511 can be found here:

https://focuslcds.com/wp-content/uploads/Drivers/ILI2511.pdf

7.9 Typical Application Circuit

For the typical application circuit, see the diagram on pages 18-19 of the data sheet for touch panel IC ILI2511. The data sheet for ILI2511 can be found here: *https://focuslcds.com/wp-content/uploads/Drivers/ILI2511.pdf*

8. Quality Inspection Standards

For TFT quality inspection standards, please see the following link: *https://focuslcds.com/lcd-resources/tft-quality-inspection-standards/*

9. Cautions and Handling Precautions

9.1 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 fingerstalls 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 Power On Sequence & Power Off Sequence.

9.2 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 ℃ and relative humidity of less than 70%.
2. Do not store the TFT-LCD 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.