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Ph. 480-503-4295 | NOPP@FocusLCDs.com

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

TFT Display Module

Part Number

E096GA-SW500-N

Overview:

- 0.96-inch TFT (13.3x27.95mm)
- 80x160 Pixels
- SPI 4 Interface
- -20C to 80C Operating Temp.
- ALL View
- Transmissive
- No Touch Panel
- 400 NITS
- TFT IC: ST7735S
- 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, backlight and FPC cable. The resolution of the 0.96" TFT-LCD contains 80x160 pixels and can display up to 262K colors.

Features

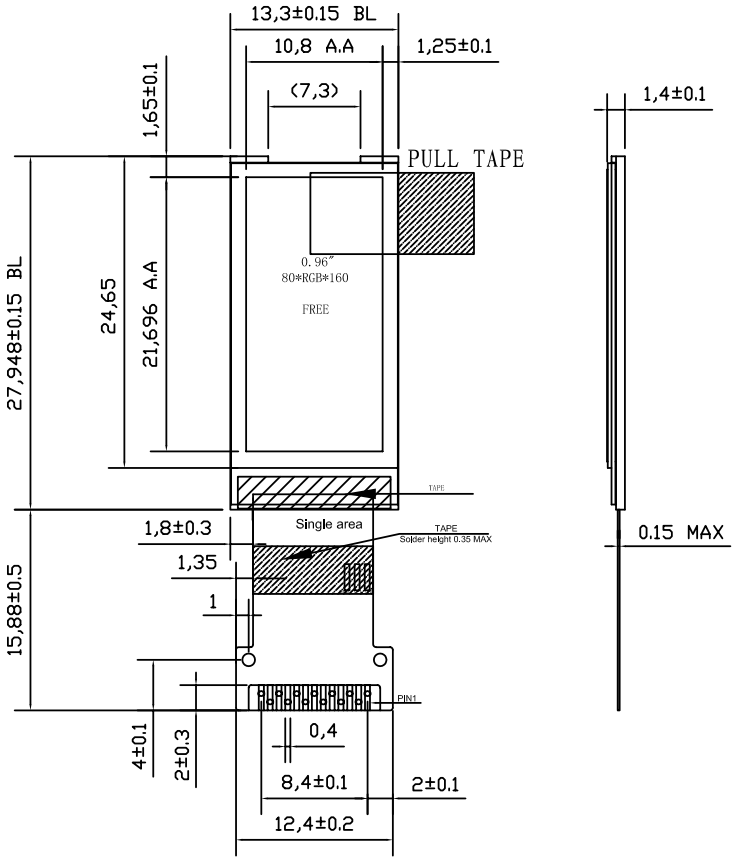
Input Voltage: 2.8V
TFT Interface: SPI 4

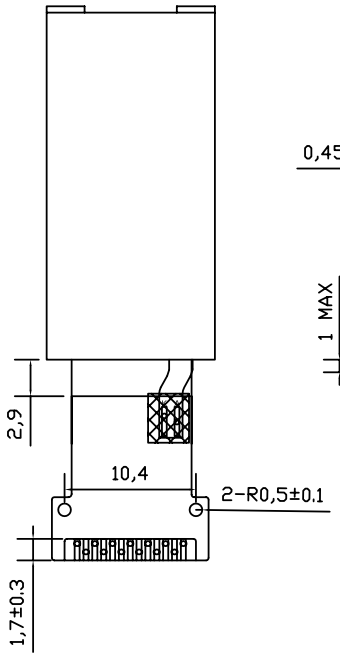
General Information Items	Specification	Unit
	Main Panel	
TFT Display Area (AA)	10.8 (H) x 21.7 (V) (0.96-Inch)	mm
Driver Element	TFT Active Matrix	--
Display Colors	262K	Colors
Number of Pixels	80 RGB x 160	Dots
TFT Pixel Arrangement	RGB vertical stripe	--
Viewing Angle	ALL	O'clock
TFT IC	ST7735S	--
Interface	SPI 4	--
Display Mode	Transmissive / Normally Black	--
Operating Temperature	-20 to +70	°C
Storage Temperature	-30 to +80	°C

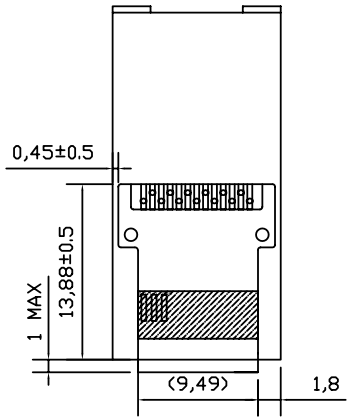
Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal (H)	--	14.04	--	mm
	Vertical (V)	--	27.95	--	mm
	Depth (D)	--	1.76	--	mm
Weight		--	TBD	--	g

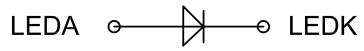
Rev.	Description	Date
1.0	First	03/30/2023







Pin Assignment	
NO.	SYMBOL
1	TP0
2	TP1
3	SDA
4	SCL
5	RS
6	RES
7	CS
8	GND
9	NC
10	VCC
11	LEDK
12	LEDA
13	GND



LED CIRCUIT DIAGRAM
VF=3.2V IF=15mA

NOTES:

1. Display Type: 0.96" TFT / Transmissive
2. Driver IC: ST7735S
3. Viewing Angle: ALL
4. Operating Temp: -20°C~70°C
5. Storage Temp: -30°C~80°C
6. Backlight Type: White Vf=3.2V/If=15mA
7. RoHS Compliant

Model Name: E096GA-SW500-N		FOCUS LCDs LCDs MADE SIMPLE®	
General Tol: ± 0.3			
Approvals	Date	Drawing No.:	Scale:
DWN:			
CHK:		Size:	Unit: mm
APP:			Page : 1/3

2. Input Terminal Pin Assignment

2.1 TFT Pin Assignment

Recommended TFT Connector: **Solderable FPC**

NO.	Symbol	Description
1	TP0(NC)	NC
2	TP1(NC)	NC
3	SDA	- When IM3 is Low, SPI interface input/output pin. - When IM3 is High, SPI interface input pin. - The data is latched on the rising edge of the SCL signal. - If not in use, fix this pin to VDDI or DGND.
4	SCL	Display data/command selection pin in parallel interface. - This pin is used to be serial interface clock.(SCL) DCX='1': display data or parameter. DCX='0': command data. - If not in use, fix this pin to VDDI or DGND.
5	RS	- Display data/command selection pin in 4-line serial interface. - Second data lane in 2 data lane serial interface. - If not in use, fix this pin to VDDI or DGND.
6	RES	LCM reset signal
7	CS	Chip selection pin
8	GND	Ground
9	NC	NC
10	VCC(2.8V)	Analog Power Supply for LCM
11	LEDK	Backlight cathode
12	LEDA	Backlight anode
13	GND	Ground

I: Input, P: Power, O: Output

3. LCD Optical Characteristics

3.1 Optical Specifications

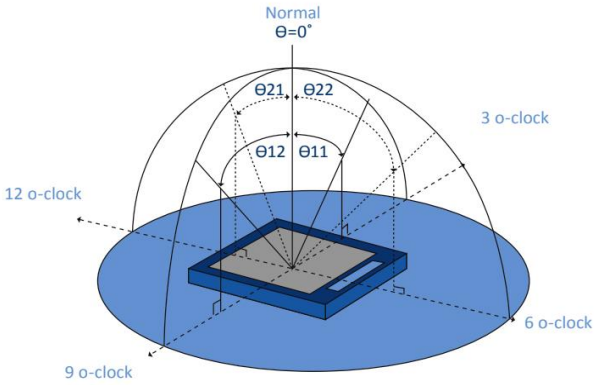
Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle Range	Left	θL	CR≧10	80	85	-	degree
	Right	θR		80	85	-	
	Top	θT		80	85	-	
	Bottom	θB		80	85	-	
Response Time		Ton+Toff	θ=Φ=0˚	-	30	40	ms
Contrast Ratio		CR	θ=Φ=0˚	700	800	-	-
Luminance		L	θ=Φ=0˚	350	400	-	cd/m2
Color Chromaticity (CIE1931)	White	Wx	Normal θ=Φ=0˚	0.26	0.31	0.36	-
		Wy		0.30	0.35	0.40	
Uniformity		UL	θ=Φ=0˚	70	-	-	%

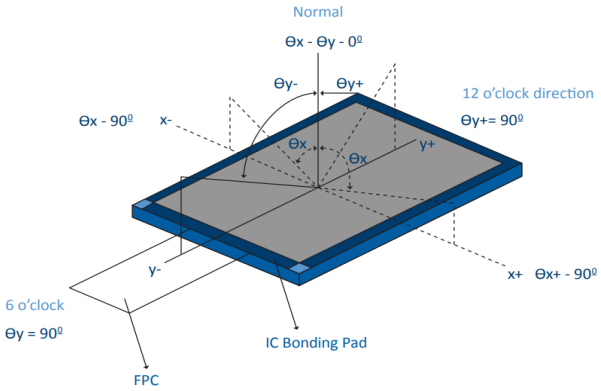
Measuring Conditions

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.



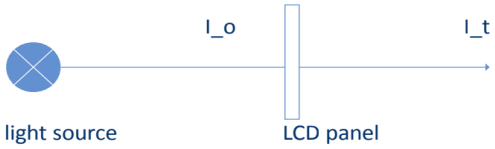


(2) Definition of Contrast Ratio (Cr): measured at the center point of panel. The contrast ratio (Cr) measured on a module, is the ratio between the luminance (Lw) in a full white area (R=G=B=1) and the luminance (Ld) in a dark area (R=G=B=0).

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

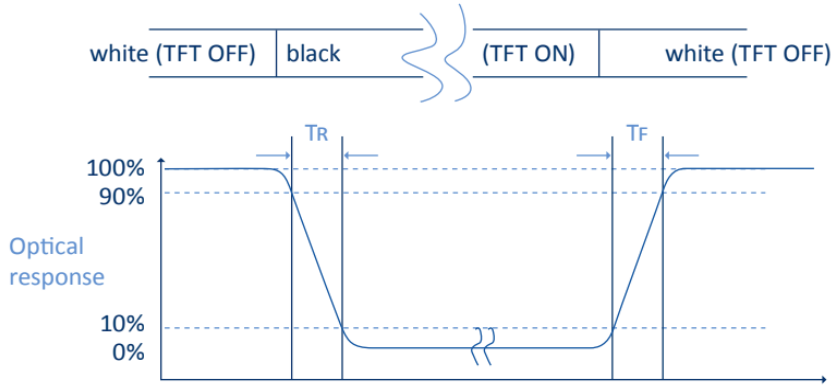
(3) Definition of transmittance (T%): The transmittance of the panel including the polarizers is measured with electrical driving. The equation for transmittance Tr is:

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



Io = the brightness of the light source.
It = the brightness after panel transmission

(4) Definition of Response Time (Tr, Tf): 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.

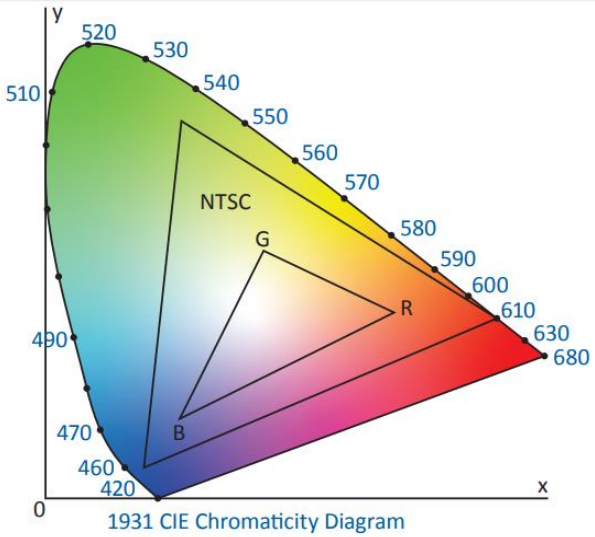
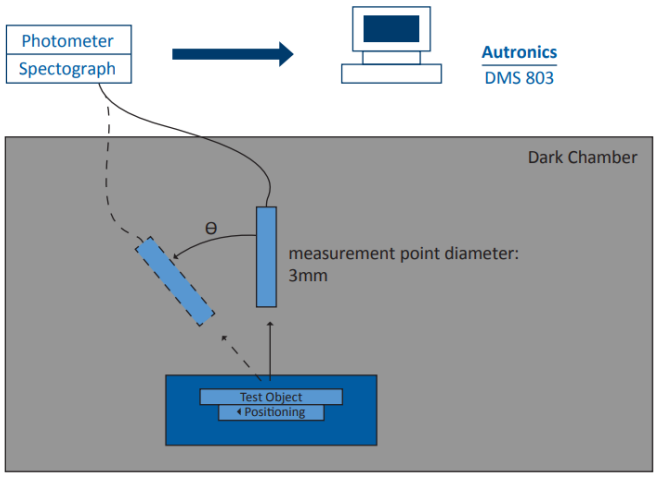


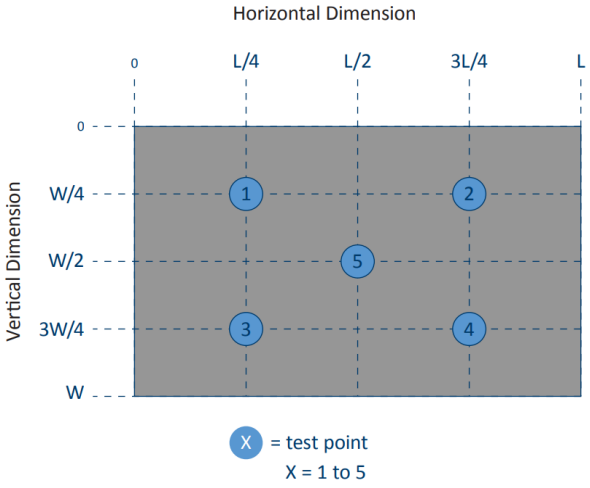
Fig. 1931 CIE chromacity diagram

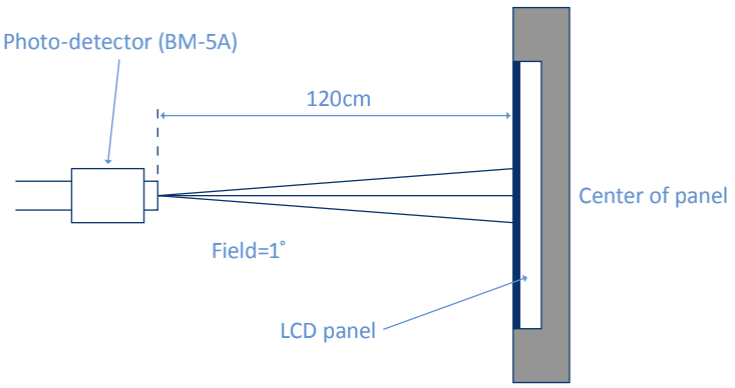
Color gamut: $S = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}} \times 100\%$

(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.







4. TFT Electrical Characteristics

4.1 Absolute Maximum Ratings (Ta=25°C, VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Analog Supply Voltage	VCC	-0.3	3.3	V

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.

4.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max	Unit
Analog Supply Voltage	VCC	2.7	2.8	3.3	V
Level Input Voltage	V_{IH}	0.8*VCC	--	VCC	V
	V_{IL}	0	--	0.2*VCC	V
Level Output Voltage	V_{OH}	0.8*VCC	--	--	V
	V_{OL}	--	--	0.2*VCC	V

4.3 LED Backlight Characteristics

This module utilizes an edge-lit backlight system with 1 LED.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	--	20	--	mA	
Forward Voltage	V_F	2.7	3.1	3.4	V	
LCM Luminance	L_V	--	400	--	cd/m²	(3)
LED Lifetime	H_r	--	50000	--	Hour	(1)(2)
Uniformity	Avg	70	80	--	%	(3)

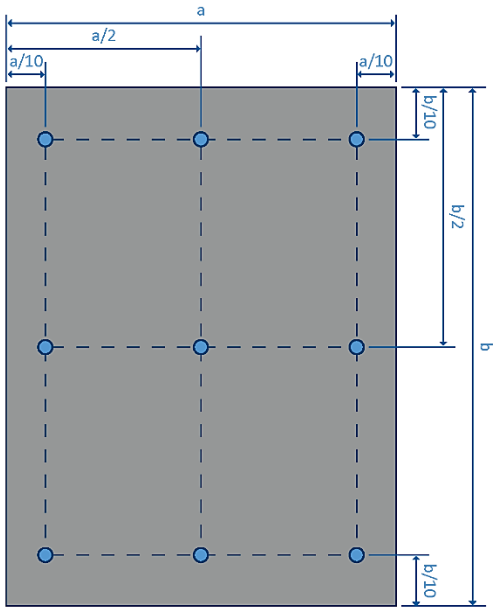
Note 1: *LED lifetime (H_r) can be defined as the time in which it continues to operate under the condition: Ta = 25±3°C, typical IL value indicated in the above table until the brightness becomes less than 50%.*

Note 2: *The "LED lifetime" is defined as the module brightness decrease to 50% original brightness at Ta = 25°C and IF = 20mA. The LED lifetime could be decreased if operating I_F is larger than 20mA. The constant current driving method is suggested.*

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

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

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



5. Quality Inspection Standards

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

6. Cautions and Handling Precautions

6.1 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 moduleduring assemblywork.
2. Protect the module from physical shock or any force. In addition to damage, this may cause improperoperation 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 thesurface.
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 assemblyprocess.
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.

6.2 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 bestressed.