



TFT GRAPHIC DISPLAY MODULE DATASHEET



Datasheet Release Date 2022-06-07
For
CFAF240240A3-013TN-E1

Crystalfontz America, Inc.

12412 East Saltese Avenue
Spokane Valley, WA 99216-0357
Phone: 888-206-9720
Fax: 509-892-1203
Email: support@crystalfontz.com
URL: www.crystalfontz.com



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1. General Information

Datasheet Revision History

Datasheet Release: **2022-06-07**
Datasheet for the CFAF240240A3-013TN-E1 TFT graphic display module.

Product Change Notifications

You can check for or subscribe to [Part Change Notices](#) for this display module on our website.

Variations

Slight variations between lots are normal (e.g., contrast, color, or intensity).

Volatility

This display module has volatile memory.

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2. Module Description

This is a full color TFT graphic display module with a white LED backlight mounted to an adapter board with backlight driver circuit. This display has a built-in Sitronix ST7789H2 controller.

Please see [Sitronix ST7789H2 LCD Controller Datasheet](#) for further reference.

3. Features

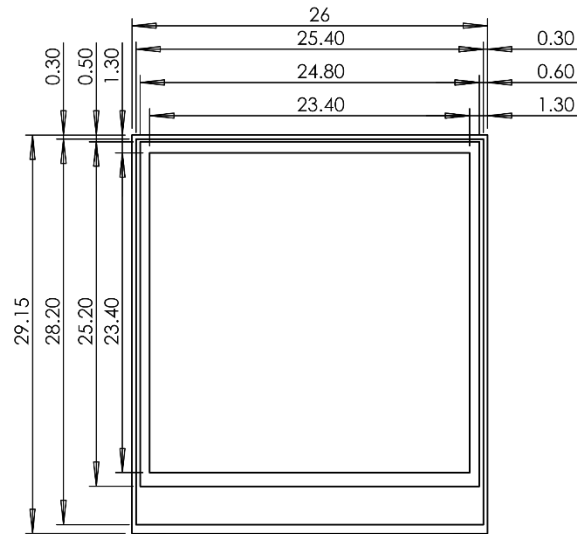
- 240 x 240 Dot Matrix
- Viewing Direction: Free
- Built-in Controller: Sitronix ST7789H2 (or equivalent)
- Operating Temperature: -20°C to 70°C
- Storage Temperature: -30°C to 80°C
- +3.3v Power
- SPI Interface

4. Mechanical Data

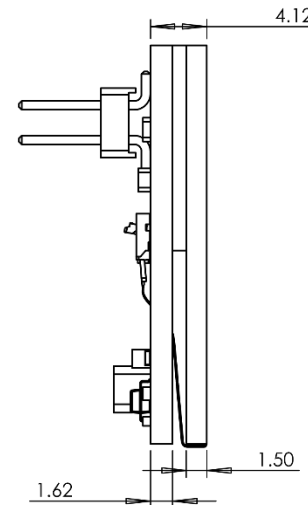
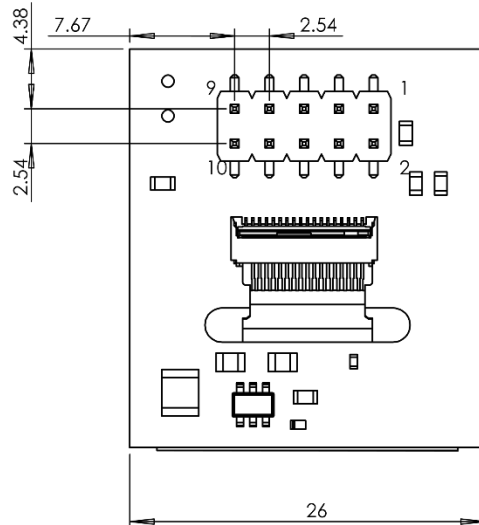
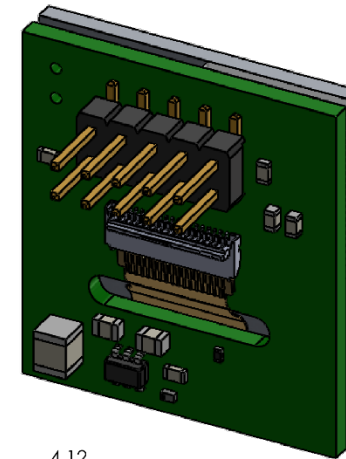
Item	Specification (mm)	Specification (inch, reference)
Overall Dimensions (including header)	26.0 (W) x 29.15 (H) x 13.75 (D)	1.02 (W) x 1.15 (H) x 0.5 (D)
Viewing Area	25.5 (W) x 25.4 (H)	1.004 (W) x 1.000 (H)
Active Area	23.4 (W) x 23.4 (H)	0.921 (W) x 0.921 (H)
Dot Pitch	0.0975 (W) x 0.0975 (H)	0.004 (W) x 0.004 (H)
Weight (Typical)	5.5 grams	0.19 ounces

5. Mechanical Drawing

Pin	Function
1	3v3
2	GND
3	SDA
4	SCLK
5	D/C
6	SDO
7	/RST
8	/CS
9	PWM
10	TE



Flex tail extends below in this area. Do not apply pressure to flex tail.

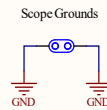
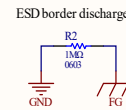
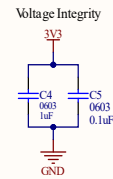
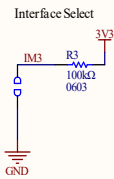
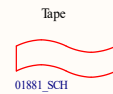
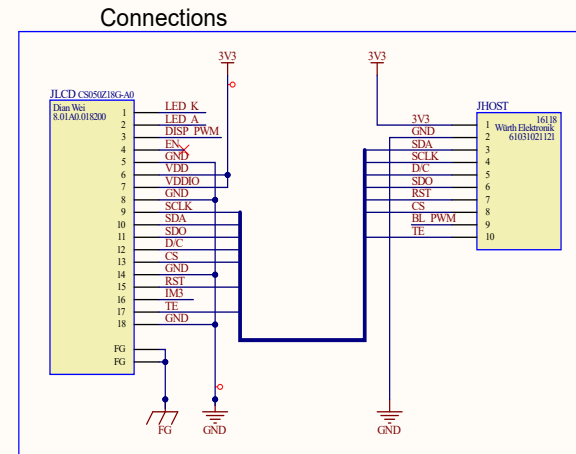
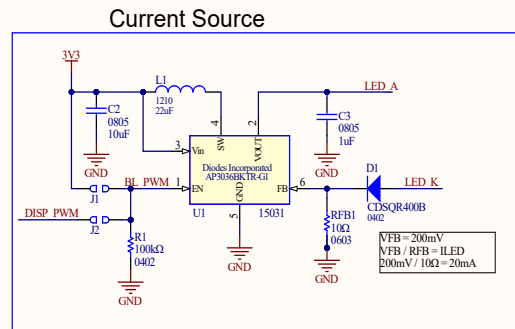


Units: millimeters
Tolerance: ± 0.3

Display Controller	ST7789H2
Brightness	320 cd/m ²
Viewing Direction	Free
Operating Temperature	-20 to 70°C
Voltage Levels	3.3v



6. Adapter Board Schematic



Crystalfontz America, Inc.		Copyright © 2021 Crystalfontz America, Inc.
CFAF240240Ax-013T Adapter Board		
Page 1 / 1 : Main Schematic Sheet		
PCB NUMBER: 10107	PCB REVISION: h0v4	Size: B
File: cfa_10107.SchDoc		



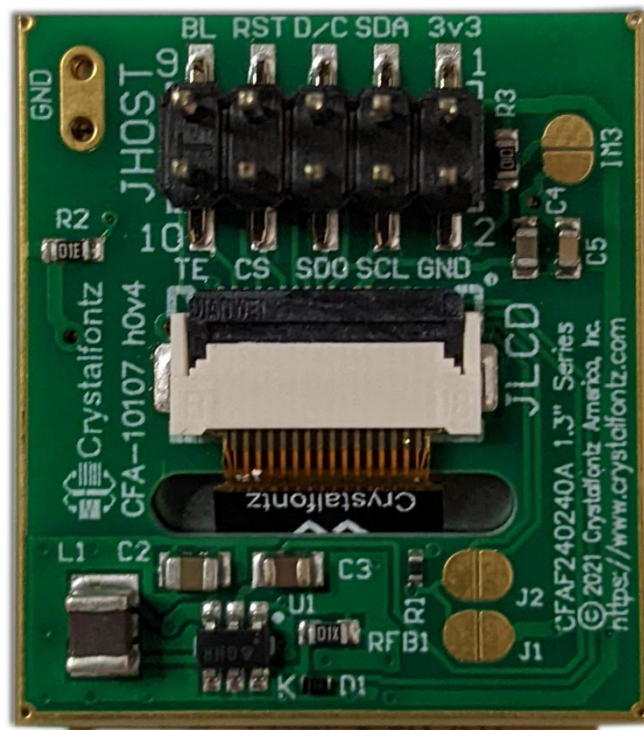
7. Interface Pin Function (JHOST)

PIN No.	Symbol	Function
1	3v3	Supply Voltage
2	GND	Ground
3	SDA	IM3: Open, Serial input/output pin IM3: Closed, Serial input pin (MOSI)
4	SCLK	Serial Interface Clock
5	D/C	Data/Command pin High = Data Register, Low = Command Register
6	SDO	IM3: Open, not used – leave open IM3: Closed, Serial output pin (MISO)
7	/RST	Reset Active Low
8	/CS	Chip Select Active Low
9	PWM	CABC: PWM out to control the backlight driving circuit. Leave open if not in use.
10	TE	Tearing effect pin used to synchronize MCU to frame memory writing (output) Leave open if not in use.

8. Jumpers

The board includes several jumpers to provide additional control of the display.

1. The **IM3** jumper is open by default in 8-bit (4-wire) SPI mode. To transition to 9-bit (3-wire) SPI, close the IM3 jumper.
2. The **J2 DISP PWM** jumper is open by default. Closing this jumper connects the display's built-in pulse width modulation (PWM) feature to the backlight driver.
3. The **J1 BL_PWM** jumper is open by default. Closing this jumper connects the backlight driver to the 3.3v line for a continuous bright backlight.



9. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
3.3 Volt Supply	3v3	-0.3	4.6	V
Operating Temperature	T _{OP}	-20	+70	°C
Storage Temperature	T _{STG}	-30	+80	°C

Note: These are stress ratings only. Extended exposure to the absolute maximum ratings may affect device reliability or cause permanent damage. Functional operation should be restricted to the limits in the Electrical Characteristics table below.

10. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
3.3 Volt Supply	3v3	-	2.4	3.3	3.3	V
High-level Input	V _{IH}	-	0.7 x V _{DDIO}	-	V _{DDIO}	V
Low-level Input	V _{IL}	-	GND	-	0.2 x V _{DDIO}	V

11. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	
Transmittance	T	-	4.1	4.59	-	%	
Response Time	T _{rise} + T _{fall}	-	-	30	35	ms	
White Chromaticity	x	Ta = 25°C	0.2563	0.3063	0.3563		
	y		0.2870	0.3370	0.3870		
Red Chromaticity	x		0.5414	0.5914	0.6414		
	y		0.2886	0.3386	0.3886		
Green Chromaticity	x		0.2732	0.3232	0.3732		
	y		0.4900	0.5400	0.5900		
Blue Chromaticity	x		0.0987	0.1487	0.1987		
	y		0.0408	0.0908	0.1408		
Viewing Angle, Horizontal	θ _x		CR≥10	-	160	-	deg
Viewing Angle, Vertical	θ _y			-	160	-	deg
Contrast Ratio	CR		Θ = 0, Dark, 25±2°C	600	800	-	-

12. Backlight Characteristics

Item	Condition	Symbol	Min	Typ	Max	Unit
Forward Current (1)		I _F	-	20	20	mA
Forward Voltage	I _F =20mA	V _F	2.5	2.9	3.3	V
Luminous Intensity for LCM		I _v	250	320	-	cd/m ²
Uniformity for LCM		-	70	-	-	%
LED Lifetime (2)		-	20K	-	-	Hr.
Color		White				

Note: Lifetime is defined as the amount of time when the luminance has decayed to <50% of the initial value (20K hours is an estimate for reference only).



13. LCD Module Precautions

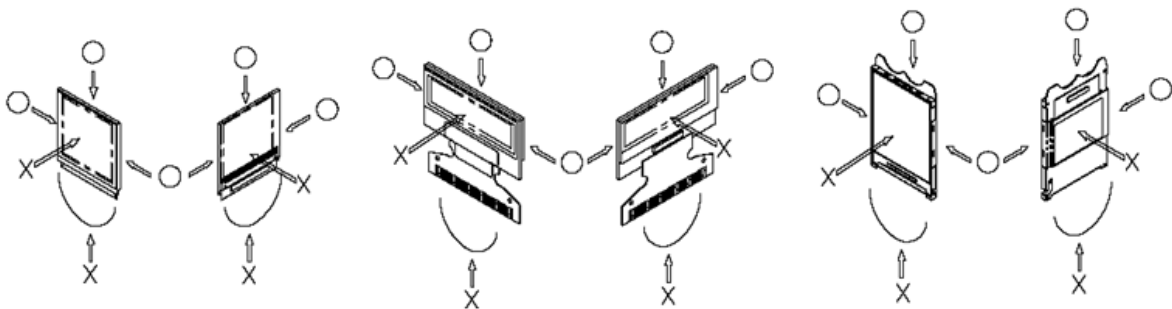
These precautions help ensure personal safety, module performance, and compliance with environmental regulations when using an LCD module.

13.1. Modules

- Avoid excessive physical and electrical shocks to module.
- Do not drop, bend, or twist the LCD display module.
- Do not make extra holes, modify the shape, or change the components of the printed circuit board.
- Do not disassemble the LCD display module.
- Do not operate the LCD display module outside the absolute maximum rating.
- Only solder to the I/O terminals.
- Store in an anti-static electricity container and clean environment.
- Do not display static information for long periods of time to avoid burn in.
- Crystalfontz has the right to change passive components on the display module. Resistors, capacitors and other passive components may have different appearance and color.
- Crystalfontz has the right to change the PCB revision/version in order to satisfy the supply stability, management optimization, the best product performance, etc., under the premise of not affecting the electrical characteristics and external dimensions.

13.2. Handling Precautions

- The display panel is made of glass. Do not apply mechanical impacts, stress or pressure to the LCD display module.
- Pressure applied to or near the display surface may damage the cell structure.
- If the display panel is accidentally broken and the internal organic substance leaks out, do not inhale or touch the organic substance.
- The polarizer covering the surface of the LCD display module is soft and can be easily scratched. Cover the polarizer in the final design.
- Clean the surface of the polarizer using Scotch Mending Tape No. 810 or an equivalent
 - Never breathe on the surface or wipe the surface using a cloth containing solvent such as ethyl alcohol, as the surface of the polarizer will become cloudy.
 - Water, ketone, and aromatic solvents may ruin the polarizer.
- Do not over bend the film with electrode pattern layouts. This can affect the display performance.



- Do not apply stress to the LSI chips and the surrounding molded sections.
- Do not apply input signals while the logic power is off.
- Prevent damage by electrostatic discharge (ESD) when handling the LCD display module:
 - Ground personnel handling LCD display modules.
 - Ground tools used for assembly such as soldering irons.
 - To suppress generation of ESD, avoid carrying out assembly work under dry environments.
 - Remove the protective film applied to the display panel slowly as ESD may be generated when removing the film.
- Protective film is applied to the surface of the display panel. Remove the film before assembly. If the LCD display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after the film has been removed. In such a case, remove the residue material as discussed above.

13.3. Storing Precautions

- Store the LCD display modules in ESD preventative bags. Avoid exposure to direct sunlight and fluorescent lamps. Avoid high temperature and high humidity environments and low temperature (less



than 0°C) environments. We recommend storing these modules in the packaged state in which they were shipped from Crystalfontz.

- Do not let water drops or dew adhere to the packages or bags.
- If electric current is applied when water is on the surface of the LCD display module, the module may become dewed. If a dewed LCD display module is placed under high humidity environments the electrodes may become corroded.

13.4. Designing Precautions

- The absolute maximum ratings cannot be exceeded for LCD display module. If these values are exceeded, panel damage may happen.
- Satisfy the VIL and VIH specifications and, ensure the signal line cable is as short as possible to avoid signal noise.
- Install excess current preventive unit (fuses, etc.) to the power circuit. Recommend value: 0.5A
- Avoid occurrence of mutual noise interference with the neighboring devices.
- When fastening the LCD display module, fasten the external plastic housing section.
If the power supply to the LCD display module is forcibly shut down, by such errors as taking out the main battery while the LCD display panel is in operation, we cannot guarantee the quality of this LCD display module.
- Connection (contact) to any other potential than the above may lead to rupture of the IC.

13.5. Disposing Precautions

- Request qualified companies handle the industrial waste when disposing of the LCD display modules. Observe all relevant laws and regulations.

13.6. Other Precautions

- When an LCD display module is operated for a long period of time with a fixed pattern, the fixed pattern may remain as an after image or a slight contrast deviation may occur.
 - If the operation is interrupted and left unused for a while, normal state can be restored.
 - This will not cause a problem in the reliability of the module.
- To protect the LCD display module from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the LCD display modules.
 - Pins and electrodes
 - Pattern layouts such as the TCP & FPC
- With this LCD display module, the LCD driver is exposed. If this LCD driver is exposed to light, malfunctioning may occur. Design the product and installation method so that the LCD driver may be shielded from light in actual usage and during the inspection processes.
- Although this LCD display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. Therefore, it is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.
- Periodically refresh the operation statuses in the software (reset the commands and retransfer the display data), to cope with catastrophic noise.
- Resistors, capacitors, and other passive components will have different appearance and color caused by the different supplier.
- Crystalfontz has the right to upgrade and modify the product function.
- The limitation of FPC bending:

