CFA240320E0-024SC DATASHEET



CFA240320E0-024SC

Datasheet Release Date 2022-05-20

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1. General Information

Datasheet Revision History
Datasheet Release: **2022-05-20** Datasheet for the CFA240320E0-024SC 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 full color IPS TFT graphic display module has a stunning 262k color depth, bright white LED backlight, and built-in capacitive touch screen that overhangs for beautiful mounting. The display is mounted on a carrier board with an FTDI FT811 EVE graphics accelerator for both high-performance accelerated graphics and easy design integration.

3. Features

3.1. Module Features

- 240*320 Dot Matrix
- Sunlight readable LED backlight
- Wide viewing angles in all directions
- Integrated capacitive touch screen
- SPI single or Quad host interface
- Compact 30-pin, 0.5mm ZIF host connection
- 4 x 2-56 threaded mounting standoffs for simple integration
- Compact footprint
- Single 3.3v power supply

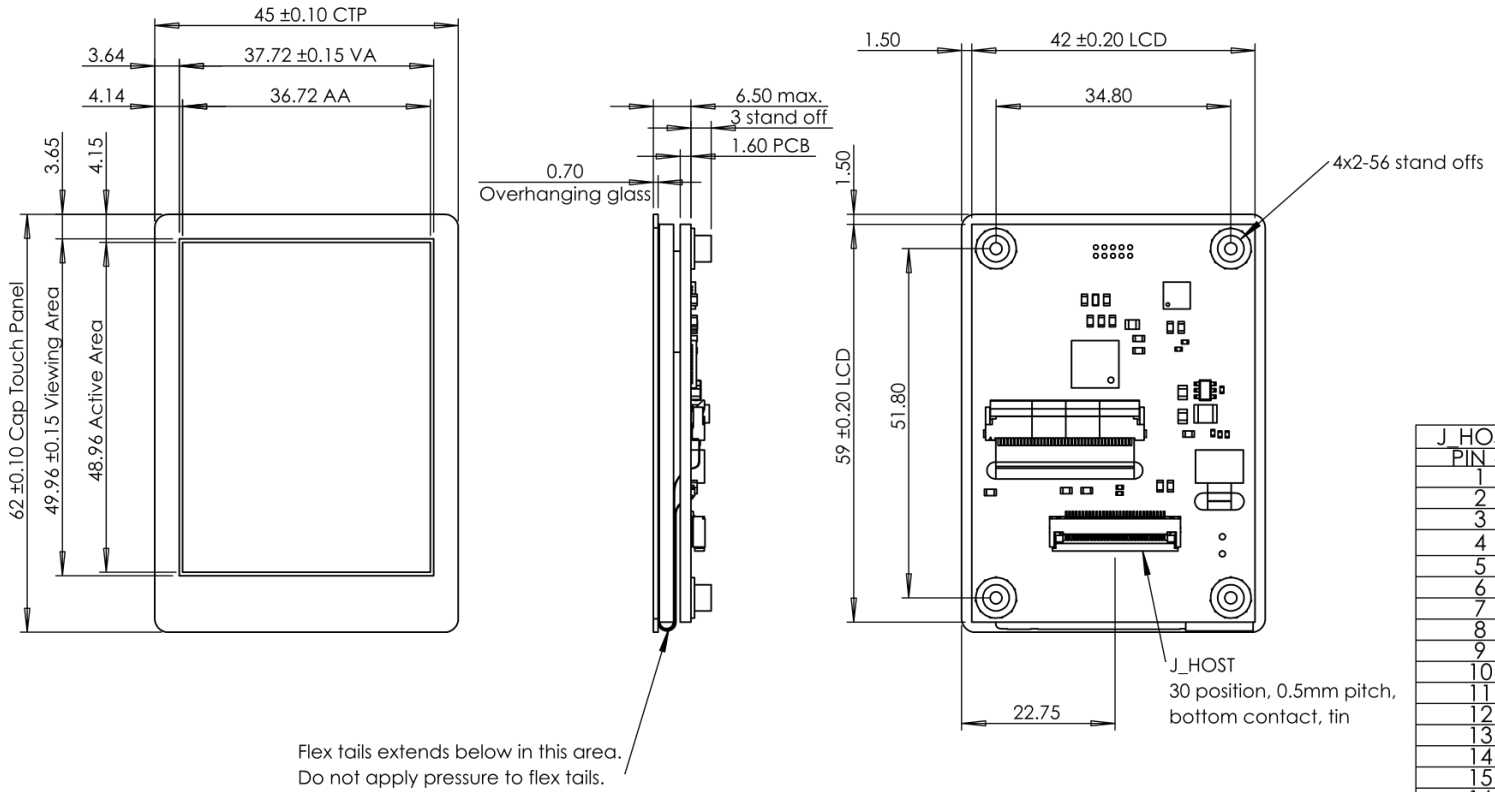
3.2. EVE Graphics Accelerator Features

- Support multiple widgets for simplified design implementation
- User interface design software (PC) simplifies the design process
- Hardware engine can recognize touch tags and track touch movement
- Enhanced sketch processing
- Anti-aliasing of primitive displayed objects for higher-quality graphics
- Assorted graphical effects such as alpha-blending, shadows, transitions, wipes, etc.
- Programmable interrupt controller provides interrupts to host MCU
- Support playback of motion-JPEG encoded AVI videos
- Mono audio channel output with wave playback and built-in sound synthesizer
- PWM output for display backlight dimming control

4. Mechanical Data

Item	Specification (mm)	Specification (inch, reference)
Overall Width and Height	45 (W) x 62 (H) x 7.56 (D)	1.77 (W) x 2.44 (H) x 0.30 (D)
Viewing Area	37.72 (W) x 49.96 (H)	1.49 (W) x 2.00 (H)
Active Area	36.72 (W) x 48.96 (H)	1.45 (W) x 1.96 (H)
Dot Pitch	0.153 (W) x 0.153 (H)	0.006 (W) x 0.006 (H)
Weight (Typical)	28 grams	1 ounce

5. Mechanical Drawing



J_HOST CONNECTOR	
PIN #	FUNCTION
1	GND
2	3V3
3	3V3
4	GND
5	3V3
6	3V3
7	GND
8	SCK
9	GND
10	MOSI/D0
11	GND
12	MISO/D1
13	GND
14	GPIO0/D2
15	GND
16	GPIO1/D3
17	GND
18	nCS
19	GND
20	nINT
21	GPIO2
22	nPD
23	AUDIO PWM
24	GND
25	BLPWR
26	BLPWR
27	GND
28	BLPWR
29	BLPWR
30	GND

Controller	FT811 EVE
Brightness	730 nits
Viewing Direction	All
Operating Temperature	-20 - 70°C
Voltage Levels	3.3v

Units: millimeters
Tolerance: ±0.3

Crystalfontz	Part Number:	Date:	Filename:	Revision:
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6. Module Details

6.1. General Information

The CFA240320E0-024SC is a high-brightness, sunlight readable, TFT display module based around a FTDI/BridgeTek FT811 Embedded Video Engine (EVE).

All display, touch sensing, backlight control and audio features are controlled via the Embedded Video Engine which appears to the host MCU as a memory-mapped SPI device. The host MCU sends commands and data over the EVE SPI serial protocol.

For detailed BridgeTek datasheets and other development information, see the Embedded Video Engine Documentation / Resources section below.

6.2. Embedded Video Engine Documentation / Resources

- BridgeTek FT81x Datasheet: https://brtchip.com/ft81x/
- BridgeTek Application Notes: https://brtchip.com/application-notes/
- BridgeTek Screen Designer Software: https://brtchip.com/eve-toolchains/
- BridgeTek Forum: http://www.brtcommunity.com/index.php?board=7.0
- FTDI FT81x Datasheets: https://www.ftdichip.com/Products/ICs/FT81X.html
- FTDI Application Notes: https://www.ftdichip.com/Support/Documents/AppNotes.htm
- FTDI C232HM USB-SPI cable: https://www.ftdichip.com/Products/Cables/USBMPSSE.htm

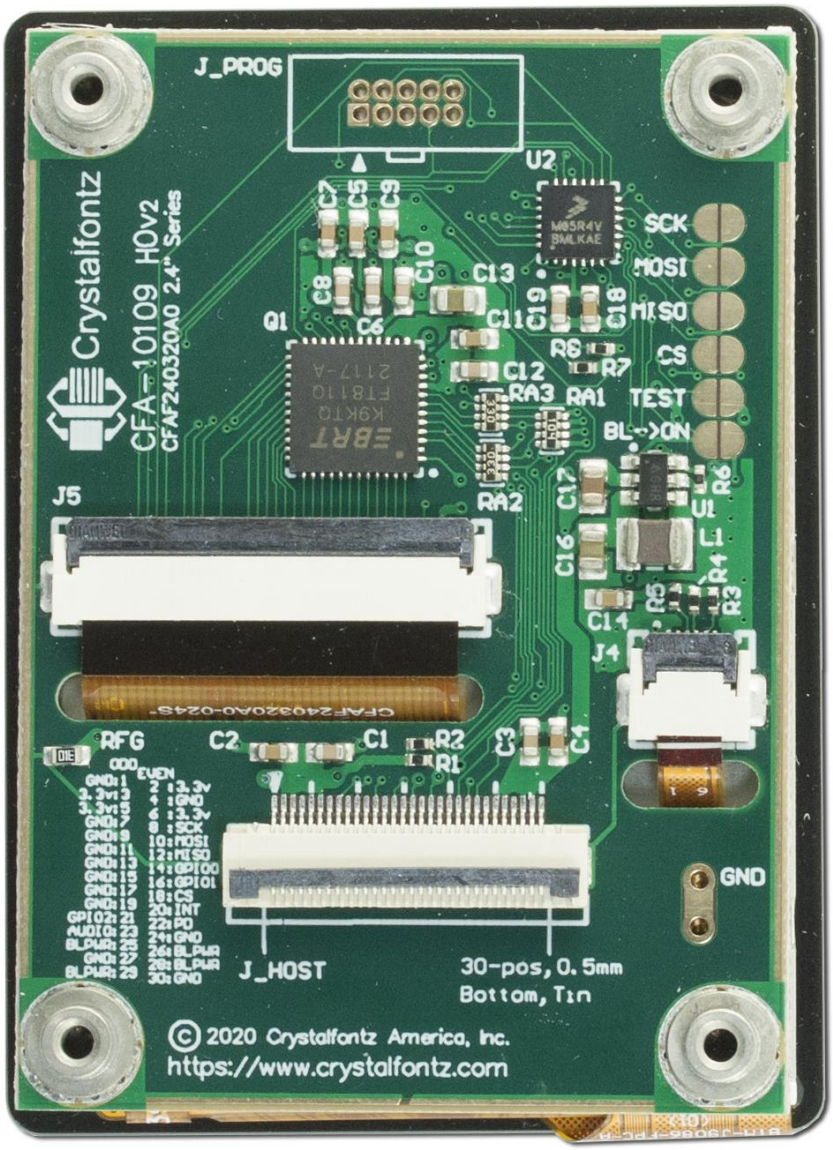
6.3. PCB Jumpers

The PCB (CFA10109) has jumpers that can be used to change the functionality of the display.

TEST: Shorting the TEST jumper when none of SCK, MOSI, MISO, and CS are shorted, causes the display to cycle through colors to demonstrate that the display functions.

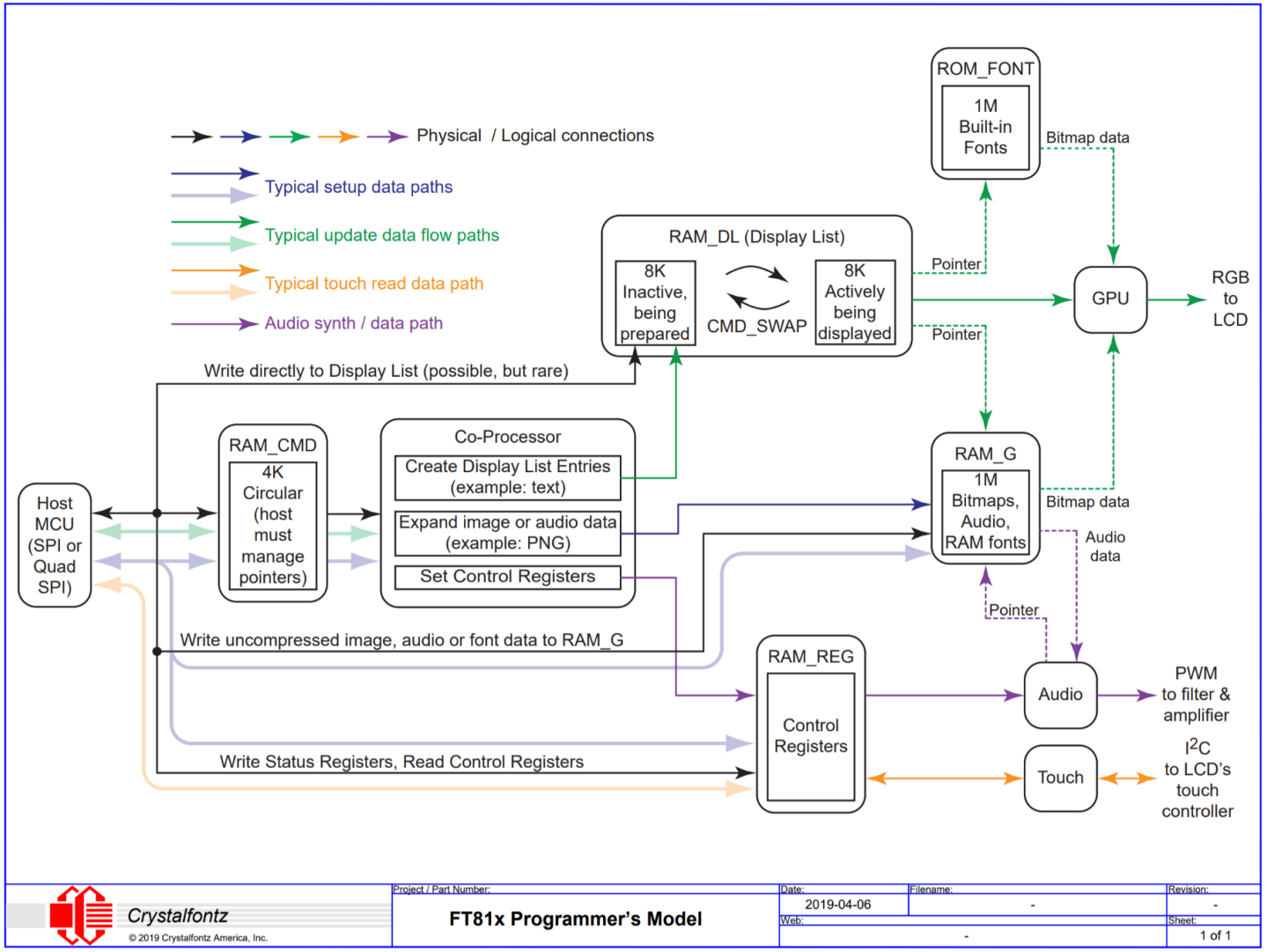
BL_ON: Shorting the BL_ON jumper causes the backlight to be on whenever the module has power.

Shorting all jumpers (BL_ON can be in either state) will cause the NXP processor SPI signals to connect to the EVE. The NXP can be used to drive the display via the EVE FT811 chip.



6.4. Embedded Video Engine Programmer's Model

The diagram below is a basic overview of the EVE programming model showing data flow paths to and from the SPI host interface to the memory and processing blocks of the embedded video engine.



6.5. Interface Pin Function

Host data connection and power supply is achieved via a single 30 pin flat-cable connector (labeled J_HOST) on the rear of the module. Any 30 pin FFC-FPC ZIF cable with a 0.5mm pitch and bottom contacts will be compatible with this module.

J_HOST Connection			
Pin	**Symbol**	**Signal Direction**	**Function**
1	GND		Ground (1)
2	3V3		Logic Power Supply (1)
3	3V3		Logic Power Supply (1)
4	GND		Ground (1)
5	3V3		Logic Power Supply (1)
6	3V3		Logic Power Supply (1)
7	GND		Ground (1)
8	SCK	Input	SPI Clock
9	GND		Ground (1)
10	MOSI / D0	Input	SPI Single Mode: SPI MOSI SPI Dual/Quad Mode: SPI Data Line 0
11	GND		Ground (1)
12	MISO / D1	Output	SPI Single Mode: SPI MISO SPI Dual/Quad Mode: SPI Data Line 1
13	GND		Ground (1)
14	GPIO0 / D2	Input / Output	SPI Single/Dual Mode: General Purpose IO0 SPI Quad Mode: SPI Data Line 2
15	GND		Ground (1)
16	GPIO1 / D3	Input / Output	SPI Single/Dual Mode: General Purpose IO1 SPI Quad Mode: SPI Data Line 3
17	GND		Ground (1)
18	nCS	Input	SPI Slave Chip-Select
19	GND		Ground (1)
20	nINT	Output	Interrupt to Host
21	GPIO2		General purpose IO2
22	nPD	Input	Chip Power Down Mode
23	AUDIO PWM	Output	Audio PWM
24	GND		Ground (1)
25	BLPWR		Backlight Power Supply (1)
26	BLPWR		Backlight Power Supply (1)
27	GND		Ground (1)
28	BLPWR		Backlight Power Supply (1)
29	BLPWR		Backlight Power Supply (1)
30	GND		Ground (1)

Notes:

1. *It is recommended that these pins are all connected to their respective power source. Not doing so may produce unpredictable results or damage the display module.*

6.6. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Logic Power Supply	3V3	0.0	4.0	V
Backlight Power Supply	BLPWR	0.0	6.0	V
Operating Temperature	T_{OP}	-20	+70	°C
Storage Temperature	T_{ST}	-30	+80	°C

Notes:

- *These are stress ratings only. Extended exposure to the absolute maximum ratings listed above may affect device reliability or cause permanent damage.*
- *Temp. ≦60°C, 90% RH Maximum Temp.＞60°C Absolute humidity < 90% RH at 60°C*

6.7. Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit
Logic Power Supply	3V3	2.97	3.30	3.63	V
Input Logic High	VIH	2.0	-	3V3	V
Input Logic Low	VIL	0	-	0.8	V
Logic Supply Current	I3V3	--	54	70	mA

6.8. Backlight Characteristics

Item	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	BLPWR		2.7	3.3	5.5	V
Supply Current	IBLPWR	BLPWR=3.3V	-	106	166	mA
LED Lifetime		at 100% brightness	-	20000	-	hours

6.9. Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit
Response Time		$T_r + T_f$	25°C	-	35	-	ms
Contrast Ratio		(CR)	θ=0°	-	800	-	-
Chromaticity		Red_x	Backlight On	0.589	0.639	0.689	-
		Red_y		0.285	0.335	0.385	-
		$Green_x$		0.290	0.340	0.390	-
		$Green_y$		0.849	0.599	0.640	-
		$Blue_x$		0.093	0.143	0.193	-
		$Blue_y$		0.038	0.088	0.138	-
		$White_x$		0.265	0.315	0.365	-
		$White_y$		0.288	0.338	0.388	-
Viewing Angle	Horizontal	θL	CR≧10	-	80	-	Degree
		θR		-	80	-	
	Vertical	θT		-	80	-	
		θB		-	80	-	
Luminance		L	-	590	730	-	cd/m^2

7. Getting Started

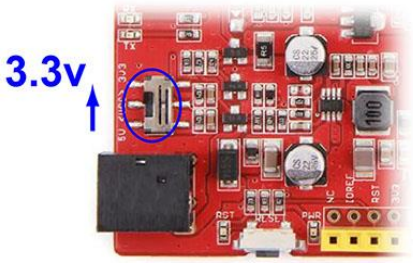
7.1. Getting started with the CFA240320E0-024SC-KIT

Components:

- Crystalfontz CFA240320E0-024SC module
- Crystalfontz CFA10098 EVE adapter board
- Appropriate flat-flex-cable (6" WR-FFC-Y50 & 12" WR-FFC-Y51)
- 0.1" female-to-female jumper wires (Crystalfontz WR-JMP-Y40)
- Seeeduino v4.2 set to 3.3 V (Crystalfontz CFAPN15062)
- USB Cable (Crystalfontz WR-USB-Y27)
- A PC with Arduino IDE (or equivalent) installed and at least one USB port

Hardware Procedure:

- Connect the components per the Example Connection Diagrams in Section 7.4
- Ensure the Seeeduino is set to 3v3
- Connect the USB cable to a PC



Firmware Procedure:

- Download and install Arduino IDE software
- Download the sketch available on the product page or on GitHub, and open it in the Arduino IDE.
- Build and upload the sketch to the Seeeduino

7.2. Getting started with the CFA240320E0-024SC and a Windows PC

Components:

- Crystalfontz CFA240320E0-024SC display module
- Crystalfontz CFA10098 EVE adapter board
- Appropriate flat-flex-cable (6" WR-FFC-Y50 & 12" WR-FFC-Y51)
- FTDI C232HM-DDHSL-0 USB-to-SPI cable
- Bench supply set to 3.3v, rated for at least 1000mA

Hardware Procedure:

- Connect the CFA10098 to the CFA240320E0-024SC using the FFC (see section 7.5 below)
- Connect the USB-to-SPI cable to the carrier board of the CFA240320E0-024SC
- Connect 3.3v from a bench supply (rated for at least 1000mA) to the CFA10098
- Connect the USB to SPI cable to a Windows PC

Software Procedure:

- Download and install the FTDI PC demonstration application from the Bridgetek website.
- Download, open, build and run the example EVE application available on GitHub.

  In order to modify and compile the FTDI PC demonstration program, requires Visual Studio. There is a free version but it may require registering with Microsoft.

7.3. Getting started with CFA240320E0-024SC and a custom PCB

Components:

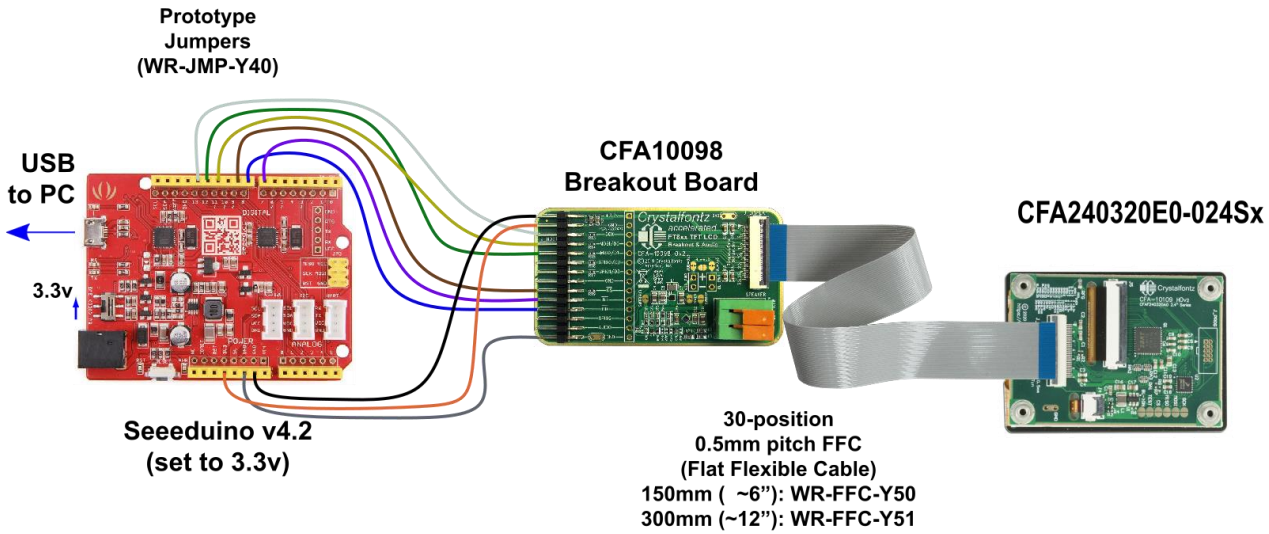
- Crystalfontz CFA240320E0-024SC display module
- ZIF connector: 30-position, 0.5mm pitch, tin contact mounted to the custom PCB (CS050Y30T-B0)
- Flat-flex-cable: 30-position, 0.5mm pitch, tin contact (6” WR-FFC-Y50 & 12” WR-FFC-Y51)

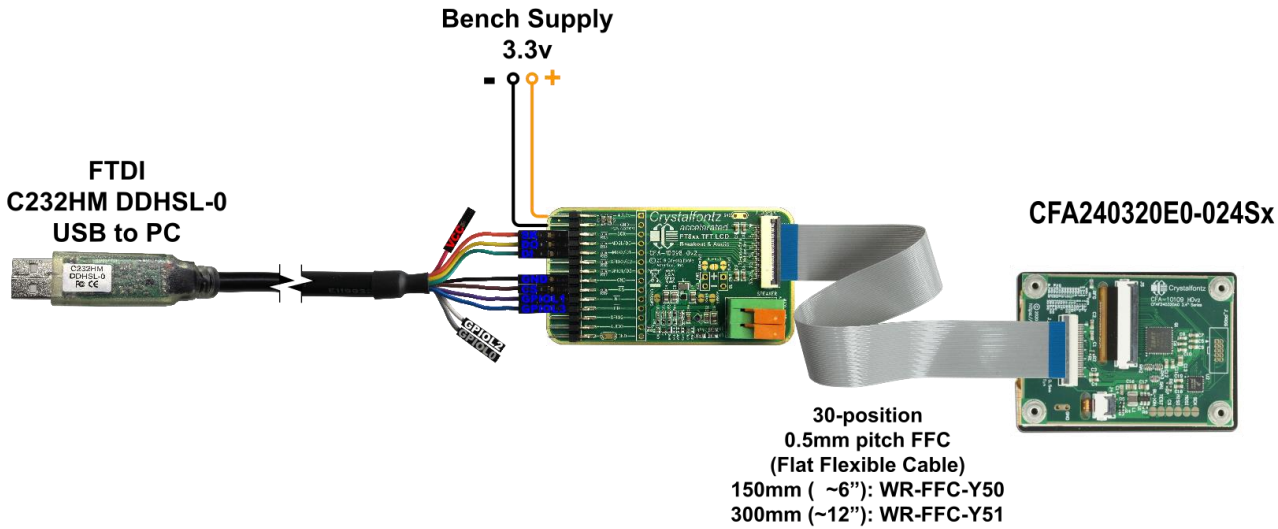
Procedure:

- Connect the FFC to the ZIF connector on the PCB
- Connect the FFC to the ZIF connector on the CFA240320E0-024SC (see the 7.5 below)

Note that the power supply must be able to supply enough current to drive the backlight.

7.4. Example Connection Diagrams

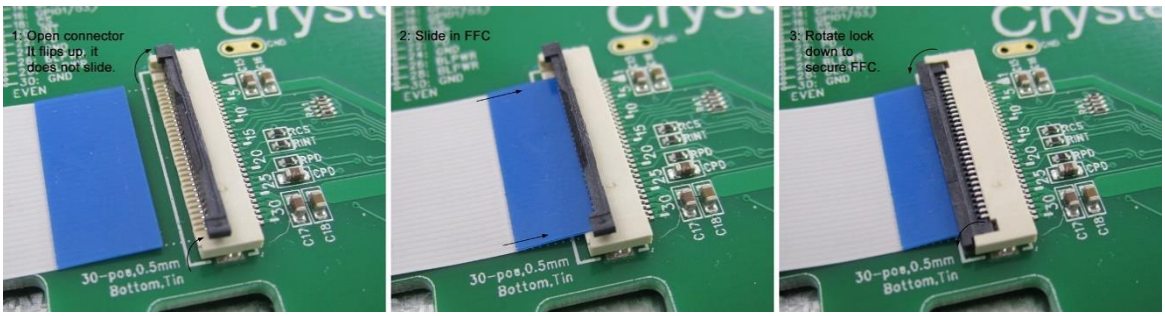




Crystalfontz © 2022 Crystalfontz America, Inc.	Project / Part Number: CFA240320E0-024Sx	Date: 2022-05-20	Filename: CFA240320E0-024Sx Block Diagram	Revision: 2022-05-20
		Web: crystalfontz.com/product/CFA240320E0024SCKIT		Sheet: 1 of 1

7.5. ZIF Connector Use With Flat-Flex-Cable (FFC)

Please take note of the orientation of the flat-flex-cable, and use of the locking clip in the following photos.



8. Care and Handling Precautions

For optimum operation of the **Error! Unknown document property name.** is and to prolong its life, please follow the precautions described below.

8.1. ESD (Electrostatic Discharge)

If present, the USB D+ & D- lines have enhanced ESD protection following industry standard USB2 practice.

The remainder of this circuitry is industry standard CMOS logic and susceptible to ESD damage. Please use industry standard antistatic precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.

8.2. Design and Mounting

- The exposed surface of the display is either a touch-sensitive panel, or a polarizer laminated on top of the glass. To protect the surface from damage, the module ships with a protective film over the display. Please peel off the protective film slowly. Peeling off the protective film abruptly may generate static electricity.
- If the display does not have a touch-sensitive panel, to protect the soft plastic polarizer from damage, place a transparent plate (for example, acrylic, polycarbonate or glass), in front of the module, leaving a small gap between the plate and the display surface.
- Do not disassemble or modify the module.
- Do not modify the six tabs of the metal bezel or make connections to them.
- Do not reverse polarity to the power supply connections. Reversing polarity will immediately ruin the module.

8.3. Mechanical Shock, Impact, Torque, or Tension

- Do not expose the module to strong mechanical shock, impact, torque, or tension.
- Do not drop, toss, bend, or twist the module.
- Do not place weight or pressure on the module.

8.4. LCD Panel Breakage

- If the LCD panel breaks, be careful to not get the liquid crystal fluid in your mouth or eyes.
- If the liquid crystal fluid touches your skin, clothes, or work surface, wash it off immediately using warm soapy water.

8.5. Cleaning

- The display surface can easily be scratched or become hazy, so use extra care when you clean it.

- Do not clean the display surface with liquids.
- If the display surface becomes dusty, carefully blow it off with clean, dry, oil-free compressed air.
- Use the removable protective film to remove smudges (for example, fingerprints), and any foreign matter. If you no longer have the protective film, use standard transparent office tape (for example, Scotch® brand “Crystal Clear Tape”).
- If the above methods are not adequate, gently wipe using a very soft, clean, dry, lint free cloth (such as a microfiber towelette).
- Contact with moisture may permanently spot or stain the polarizer.

8.6. Operation

- Protect the module from ESD and power supply transients.
- Observe the operating temperature limitations: a minimum of -20°C to a maximum of +70°C with minimal fluctuation. Operation outside of these limits may shorten life and/or harm display.
- At lower temperatures of this range, response time is delayed.
- At higher temperatures of this range, display becomes dark (you may need to adjust the contrast).
- Operate away from dust, moisture, and direct sunlight.
- Adjust backlight brightness so the display is readable, but not too bright.
- Dim or turn off the backlight during periods of inactivity to conserve the backlight lifetime.

8.7. Storage and Recycling

- Store in an ESD-approved container away from dust, moisture, and direct sunlight.
- Observe the storage temperature limitations: -30°C minimum, +80°C maximum with minimal fluctuation. Rapid temperature changes can cause moisture to form, resulting in permanent damage.
- Do not allow weight to be placed on the module while in storage.
- Please recycle your outdated Crystalfontz modules at an approved facility.