



## CFA240320E0-024SN DATASHEET



**CFA240320E0-024SN**

**Datasheet Release Date 2023-04-20**

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## 1. General Information

### Datasheet Revision History

Datasheet Release: **2023-04-20**  
Datasheet for the CFA240320E0-024SN 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 and bright white LED backlight. 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
- 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

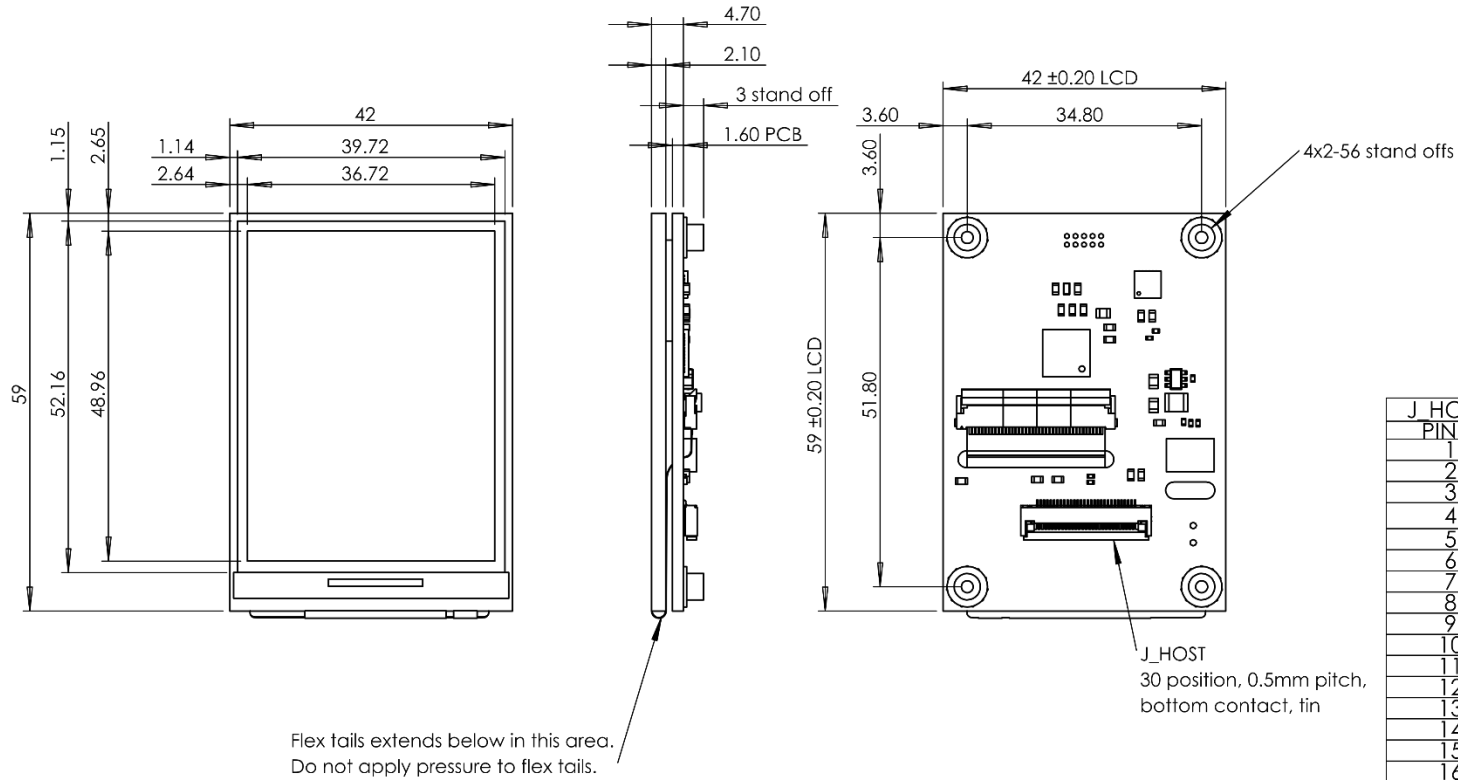
- Support multiple widgets for simplified design implementation
- User interface design software (PC) simplifies the design process
- Enhanced sketch processing
- Anti-aliasing of primitive displayed objects for higher-quality graphics
- Assorted graphical effects such as alpha-blending, shadows, transitions, 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            | 850 nits   |
| Viewing Direction     | All        |
| Operating Temperature | -20 - 70°C |
| Voltage Levels        | 3.3v       |

Units: millimeters  
Tolerance: ±0.3







## 6. Module Details

### 6.1. General Information

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

All display, 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/USBMPSSSE.htm>

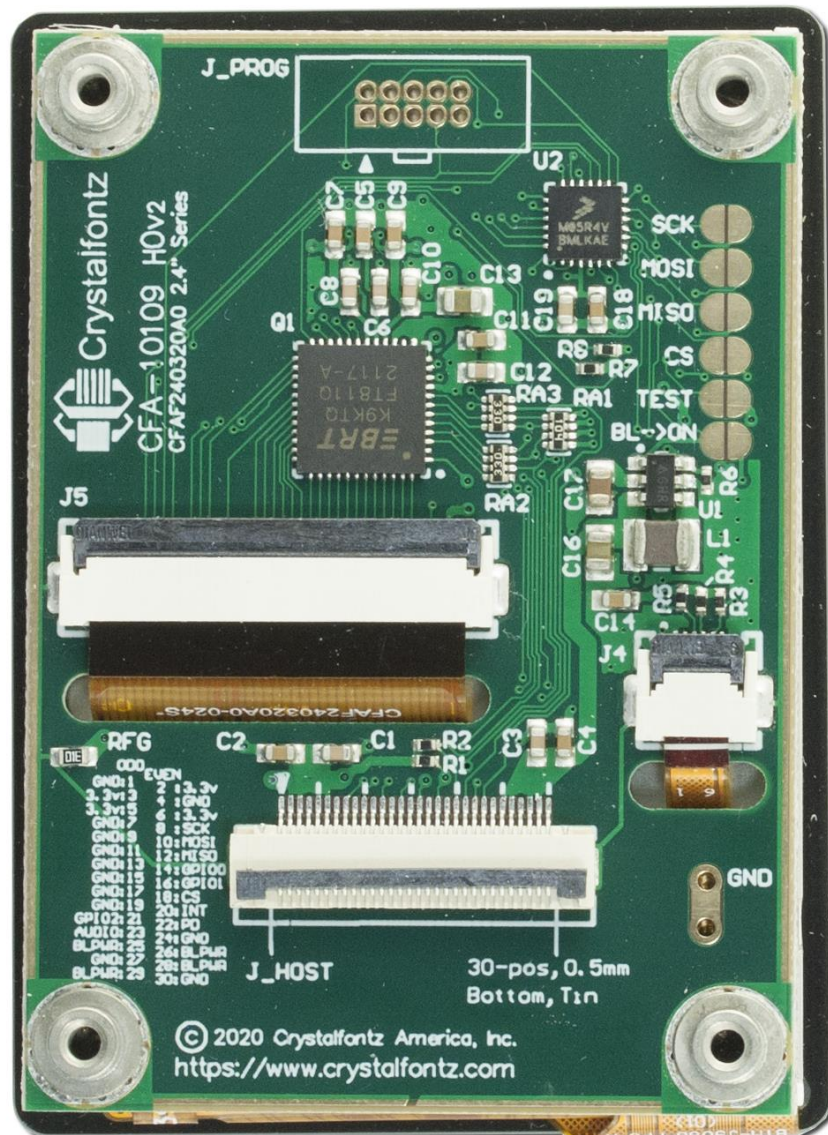
### 6.3. PCB Jumpers

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.

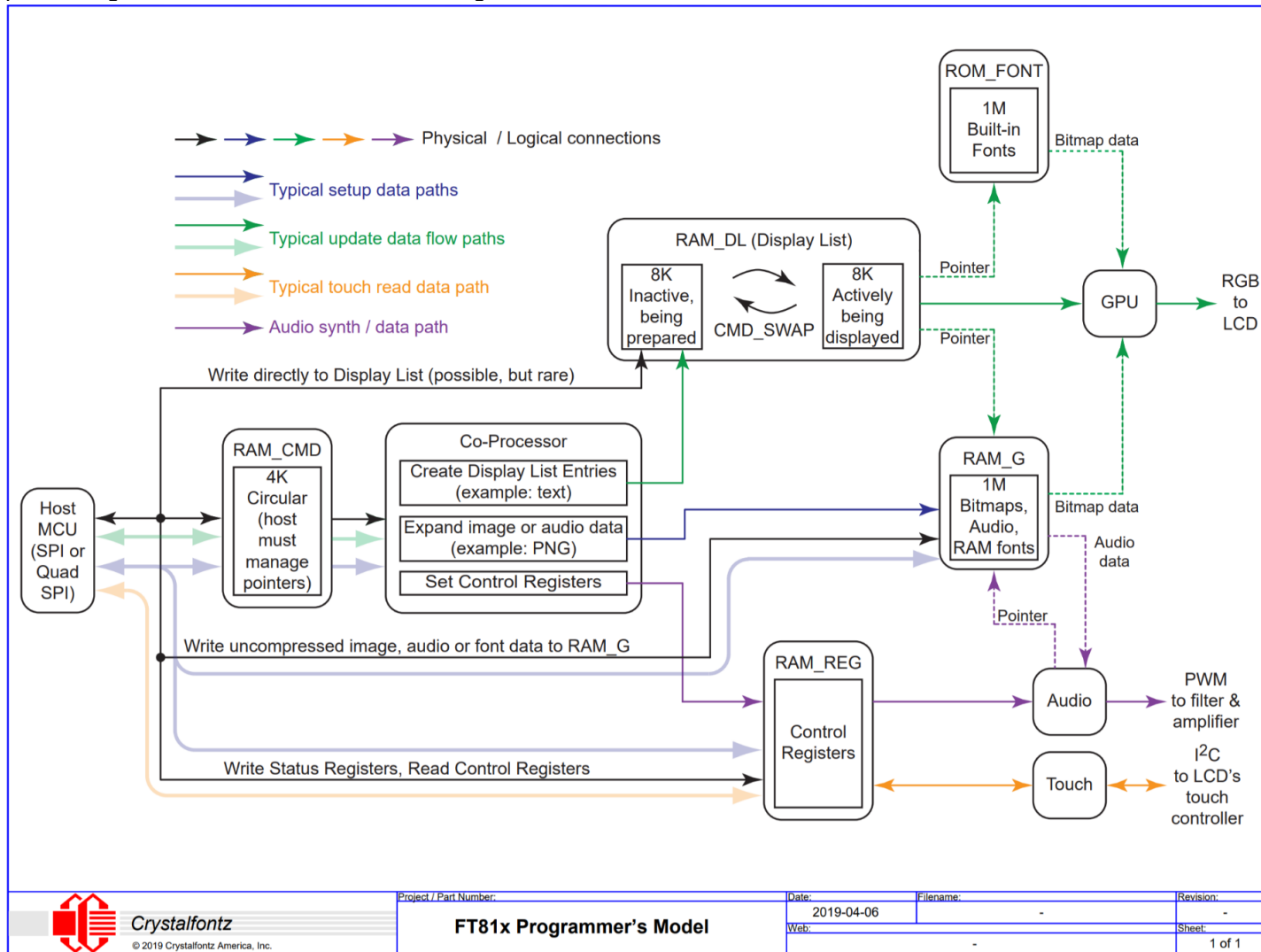
**Shorting all jumpers** (BL\_ON can be in either state) will cause the NXP processor SPI signals to connect to the EVE. The NXP can be used to drive the display via the EVE FT811 chip.





### 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.



|                          |            |           |           |
|--------------------------|------------|-----------|-----------|
| Project / Part Number:   | Date:      | Filename: | Revision: |
| FT81x Programmer's Model | 2019-04-06 | -         | -         |
|                          | Web:       |           | Sheet:    |
|                          |            |           | 1 of 1    |



## 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 <sup>(1)</sup>   |
| 2                 | 3V3        |                  | Logic Power Supply <sup>(1)</sup>   |
| 3                 | 3V3        |                  | Logic Power Supply <sup>(1)</sup>   |
| 4                 | GND        |                  | Ground <sup>(1)</sup>   |
| 5                 | 3V3        |                  | Logic Power Supply <sup>(1)</sup>   |
| 6                 | 3V3        |                  | Logic Power Supply <sup>(1)</sup>   |
| 7                 | GND        |                  | Ground <sup>(1)</sup>   |
| 8                 | SCK        | Input            | SPI Clock   |
| 9                 | GND        |                  | Ground <sup>(1)</sup>   |
| 10                | MOSI / D0  | Input            | SPI Single Mode: SPI MOSI<br>SPI Dual/Quad Mode: SPI Data Line 0            |
| 11                | GND        |                  | Ground <sup>(1)</sup>   |
| 12                | MISO / D1  | Output           | SPI Single Mode: SPI MISO<br>SPI Dual/Quad Mode: SPI Data Line 1            |
| 13                | GND        |                  | Ground <sup>(1)</sup>   |
| 14                | GPIO0 / D2 | Input / Output   | SPI Single/Dual Mode: General Purpose IO0<br>SPI Quad Mode: SPI Data Line 2 |
| 15                | GND        |                  | Ground <sup>(1)</sup>   |
| 16                | GPIO1 / D3 | Input / Output   | SPI Single/Dual Mode: General Purpose IO1<br>SPI Quad Mode: SPI Data Line 3 |
| 17                | GND        |                  | Ground <sup>(1)</sup>   |
| 18                | nCS        | Input            | SPI Slave Chip-Select   |
| 19                | GND        |                  | Ground <sup>(1)</sup>   |
| 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 <sup>(1)</sup>   |
| 25                | BLPWR      |                  | Backlight Power Supply <sup>(1)</sup>                                       |
| 26                | BLPWR      |                  | Backlight Power Supply <sup>(1)</sup>                                       |
| 27                | GND        |                  | Ground <sup>(1)</sup>   |
| 28                | BLPWR      |                  | Backlight Power Supply <sup>(1)</sup>                                       |
| 29                | BLPWR      |                  | Backlight Power Supply <sup>(1)</sup>                                       |
| 30                | GND        |                  | Ground <sup>(1)</sup>   |

**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 <sub>OP</sub> | -20 | +70 | °C   |
| Storage Temperature    | T <sub>ST</sub> | -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 | I <sub>3V3</sub> | --   | 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 <sub>r</sub> + T <sub>f</sub> | 25°C         | -              | 35    | -     | ms                |        |
| Contrast Ratio | (CR)                            | θ=0°         | -              | 800   | -     | -                 |        |
| Chromaticity   | Red <sub>x</sub>                | Backlight On | 0.589          | 0.639 | 0.689 | -                 |        |
|                | Red <sub>y</sub>                |              | 0.285          | 0.335 | 0.385 | -                 |        |
|                | Green <sub>x</sub>              |              | 0.290          | 0.340 | 0.390 | -                 |        |
|                | Green <sub>y</sub>              |              | 0.849          | 0.599 | 0.640 | -                 |        |
|                | Blue <sub>x</sub>               |              | 0.093          | 0.143 | 0.193 | -                 |        |
|                | Blue <sub>y</sub>               |              | 0.038          | 0.088 | 0.138 | -                 |        |
|                | White <sub>x</sub>              |              | 0.265          | 0.315 | 0.365 | -                 |        |
|                | White <sub>y</sub>              | 0.288        | 0.338          | 0.388 | -     |                   |        |
| Viewing Angle  | Horizontal                      | CR ≥ 10      | θ <sub>L</sub> | -     | 80    | -                 | Degree |
|                |                                 |              | θ <sub>R</sub> | -     | 80    | -                 |        |
|                | Vertical                        |              | θ <sub>T</sub> | -     | 80    | -                 |        |
|                |                                 |              | θ <sub>B</sub> | -     | 80    | -                 |        |
| Luminance      | L                               | -            | 700            | 850   | -     | cd/m <sup>2</sup> |        |

## 7. Getting Started

### 7.1. Getting started with the CFA240320E0-024SN-KIT

Components:

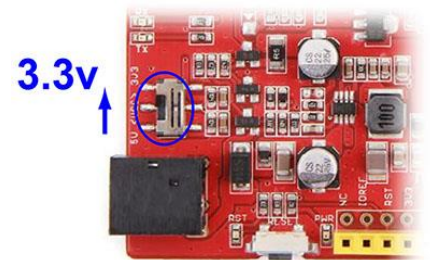
- Crystalfontz CFA240320E0-024SN [module](#)
- Crystalfontz [CFA10098](#) EVE adapter board
- Appropriate flat-flex-cable (6" [WR-FFC-Y50](#) & 12" [WR-FFC-Y51](#))
- 0.1" female-to-female jumper wires (Crystalfontz [WR-JMP-Y40](#))
- Seeeduino set to 3.3 V (Crystalfontz [CFAPN15062](#))
- USB Cable (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 CFA240320E0-024SN and a Windows PC

Components:

- Crystalfontz CFA240320E0-024SN [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 CFA240320E0-024SN using the FFC (see section 7.5 below)
- Connect the USB-to-SPI cable to the carrier board of the CFA240320E0-024SN
- 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 CFA240320E0-024SN and a custom PCB

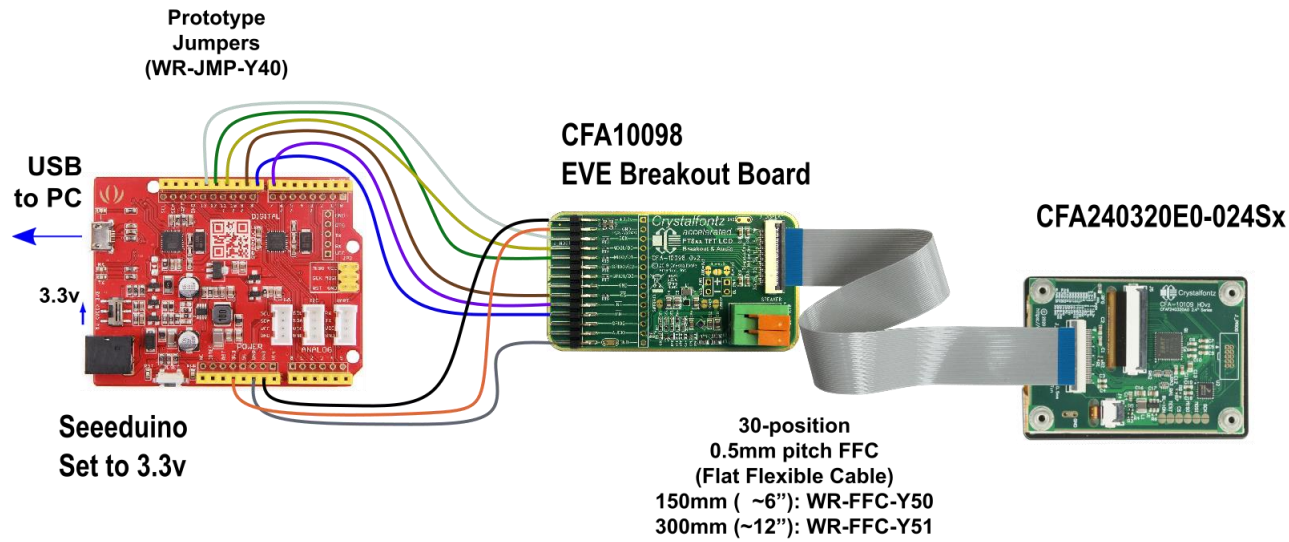
#### Components:

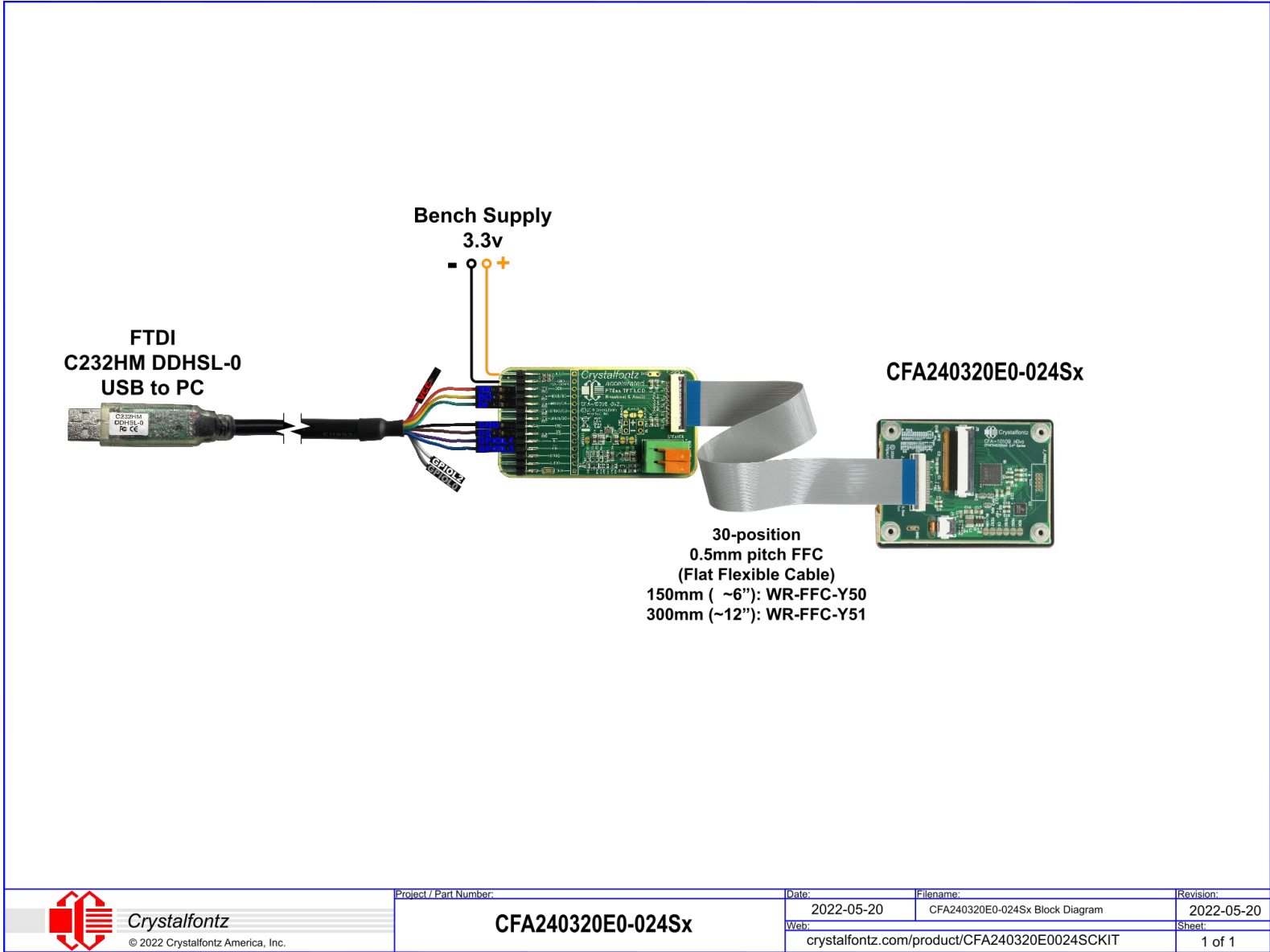
- Crystalfontz CFA240320E0-024SN [display module](#)
- ZIF connector: 30-position, 0.5mm pitch, tin contact mounted to the custom PCB ([CS050Y30T-B0](#))
- Flat-flex-cable: 30-position, 0.5mm pitch, tin contact (6" [WR-FFC-Y50](#) & 12" [WR-FFC-Y51](#))

#### Procedure:

- Connect the FFC to the ZIF connector on the PCB
- Connect the FFC to the ZIF connector on the CFA240320E0-024SN (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

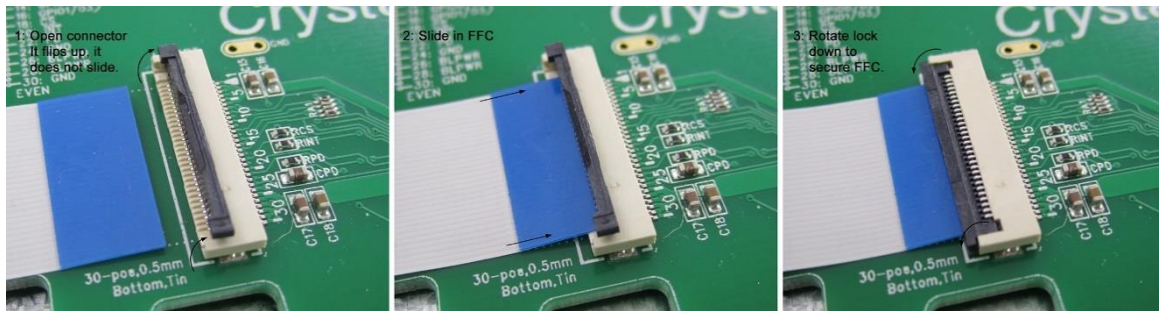






## 7.5. ZIF Connector Use With Flat-Flex-Cable (FFC)

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 and lifetime of the module, 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.