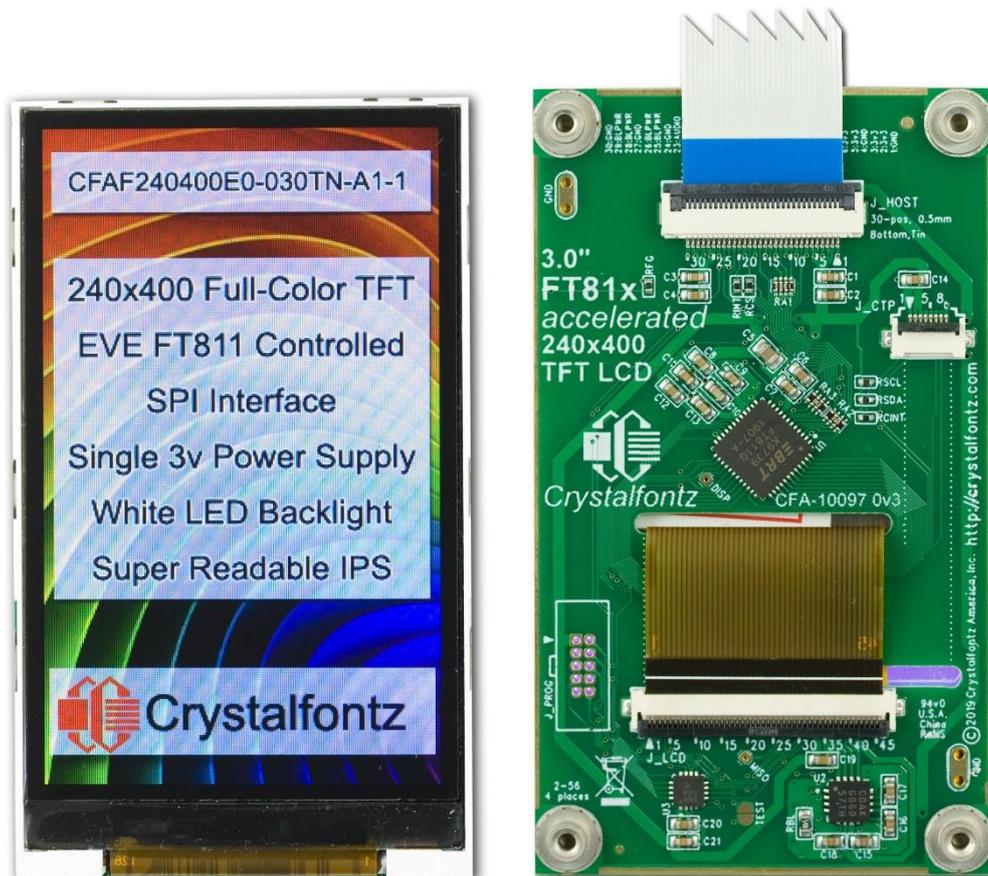




CFAF240400E0-030TN-A1-1 DATASHEET



CFAF240400E0-030TN-A1-1

Datasheet Revision A0

Datasheet Release Date 2020-05-06

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1. General Information

Datasheet Revision History

Datasheet Release: **2020-05-06**
Datasheet for the CFAF240400E0-030TN-A1-1 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 IPS TFT graphic display module with a stunning 262k color span, bright white LED backlight. The display is mounted on a CFA10097 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*400 Dot Matrix
- High brightness LED backlight
- Wide viewing angles in all directions
- SPI single or Quad host interface
- Compact 30-pin, 0.5mm ZIF host connection
- Threaded mounting standoffs for simple integration
- Compact footprint
- Single 3.3v power supply

3.2. EVE Graphics Accelerator Features

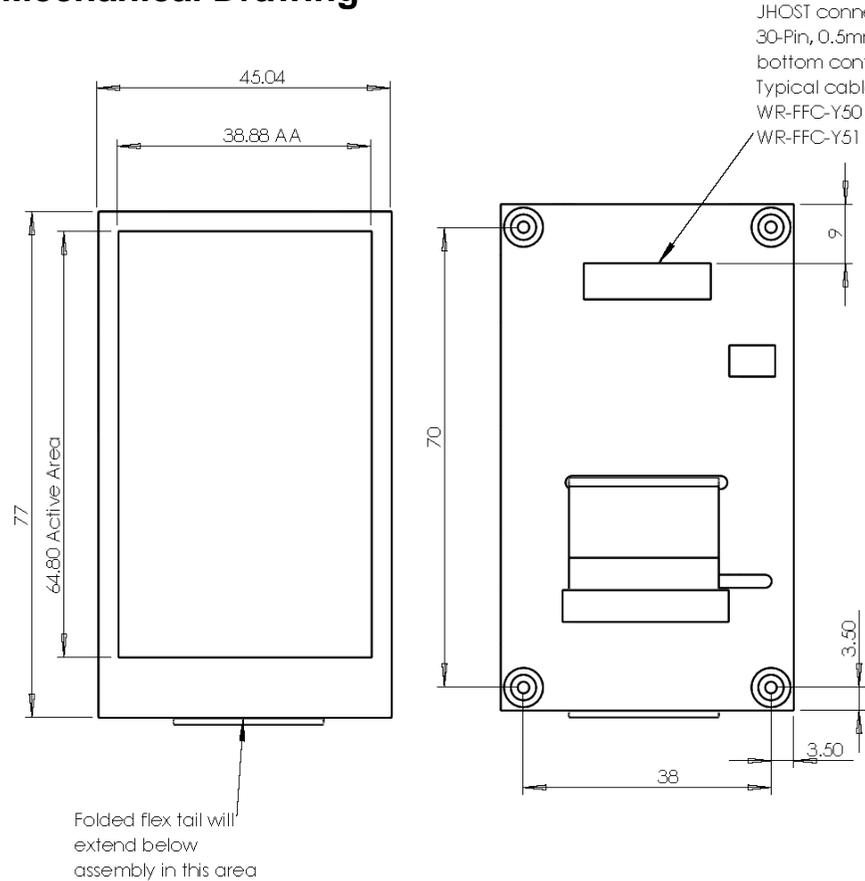
- Support multiple widgets for simplified design implementation
- User interface design software (PC) simplifies the design process
- Enhanced sketch processing
- Anti-aliasing of primitive displayed objects for higher-quality graphics
- Assorted graphical effects such as alpha-blending, shadows, transitions, 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

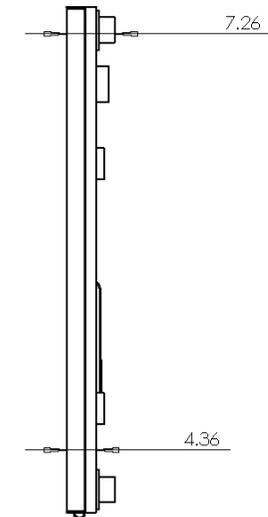
Item	Specification (mm)	Specification (inch, reference)
Overall Width and Height	45.0 (W) x 77.0 (H) x 7.3 (D)	1.77 (W) x 3.03 (H) x 0.29 (D)
Active Area	38.88 (W) x 64.80 (H)	1.53 (W) x 2.55 (H)
Dot Pitch	0.162 (W) x 0.162 (H)	0.0064 (W) x 0.0064 (H)
Weight (Typical)	29.7 grams	1.05 ounces



5. Mechanical Drawing



JHOST 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



Units: millimeters
 Tolerance: ±0.5





6. Module Details

6.1. General Information

The CFAF240400E0-030TN-A1-1 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.

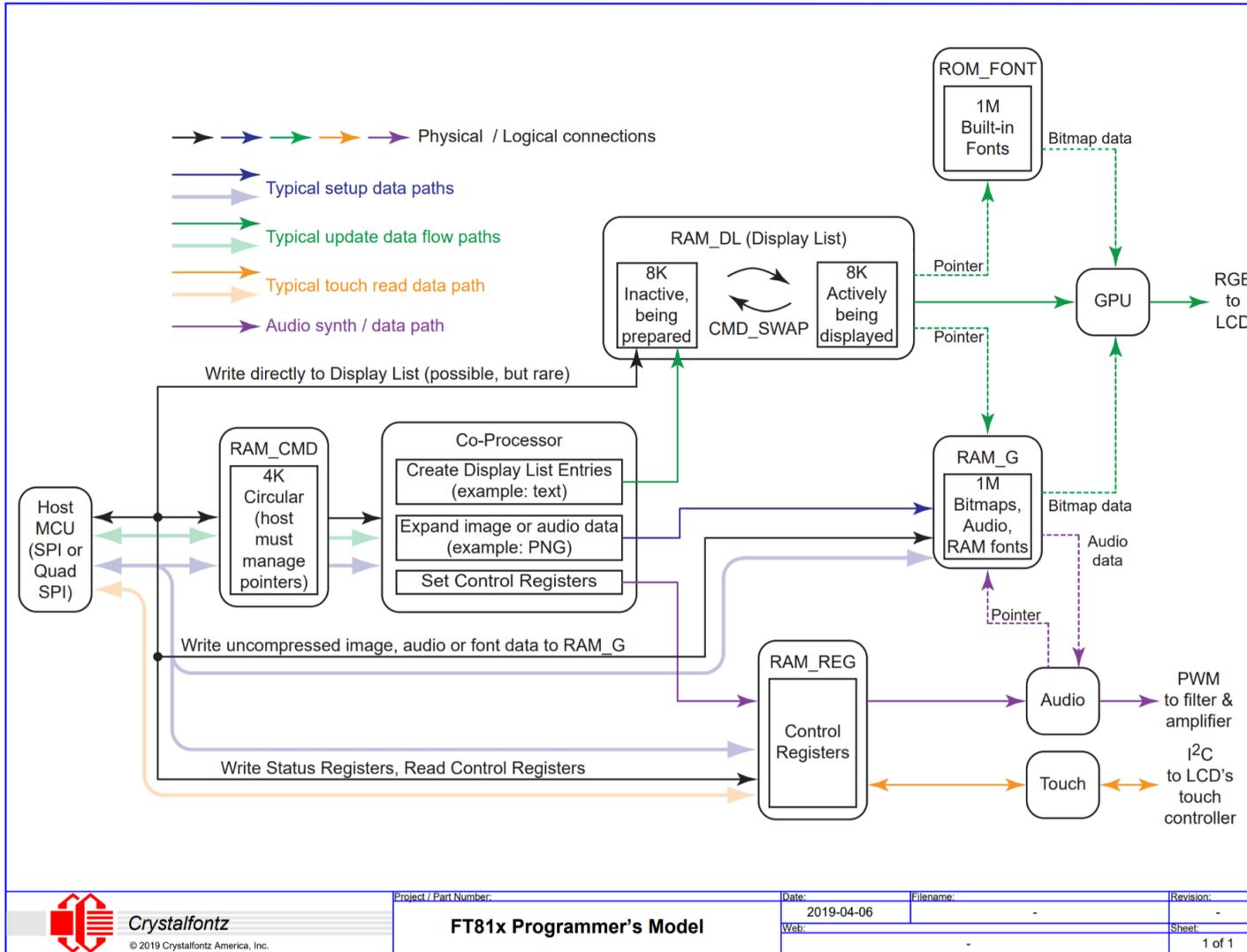
For detailed BridgeTek datasheets and other development information, see the Embedded Video Engine Documentation / Resources section below.

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. 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.





6.4. 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⁾

(1) Connect these pins to their respective power sources. Not doing so may produce unpredictable results and may damage the display module.

6.5. 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*

6.6. 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

6.7. 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	-	50000	-	hours
LCM Luminance	-	Forward current = 80mA	219	269	-	cd/m ²

6.8. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Response Time	$T_r + T_f$	25°C	-	30	-	ms
Contrast Ratio	(CR)	$\theta=0^\circ$	-	250	-	-
White Chromaticity	Wx	Backlight On	0.2411	0.2811	0.3211	ms
	Wy		0.2576	0.2976	0.3376	ms
Red Chromaticity	Rx	Backlight On	0.5858	0.6258	0.6658	ms
	Ry		0.3063	0.3463	0.3863	ms
Green Chromaticity	Gx	Backlight On	0.2968	0.3368	0.3768	ms
	Gy		0.5711	0.6111	0.6511	ms
Blue Chromaticity	Bx	Backlight On	0.1106	0.1506	0.1906	ms
	By		0.0265	0.0665	0.1065	ms
Viewing Angle	Horizontal	θ_L	-	75	-	Degrees
		θ_R	-	75	-	
	Vertical	θ_T	-	60	-	
		θ_B	-	75	-	
Viewing Direction	12 o'clock					

7. Getting Started

7.1. Getting started with the CFAF240400E0-030TN-A1-2 kit

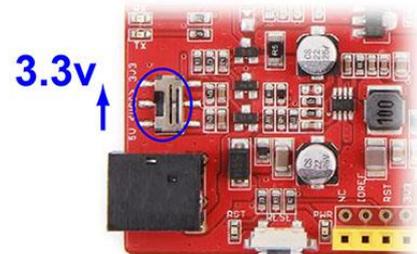
Components:

- Crystalfontz [CFAF240400E0-030-TN-A1-1](#) display 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:

7.2. 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



7.3. Getting started with the CFAF240400E0-030TN-A1-1 and a Windows PC

Components:

- Crystalfontz [CFAF240400E0-030-TN-A1-1](#) 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 CFAF240400E0-030TN-A1-1 using the FFC (see section 7.6 below)
- Connect the USB-to-SPI cable to the CFA10097 carrier board of the CFAF240400E0-030TN-A1-1
- Connect 3.3v from a bench supply (rated for at least 1000mA) to the CFA10098
- Connect the USB to SPI cable to your 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, you will need to download Visual Studio. You can use the free version but you may need to register with Microsoft.

7.4. Getting started with CFAF240400E0-030TN-A1-1 and your PCB

Components:

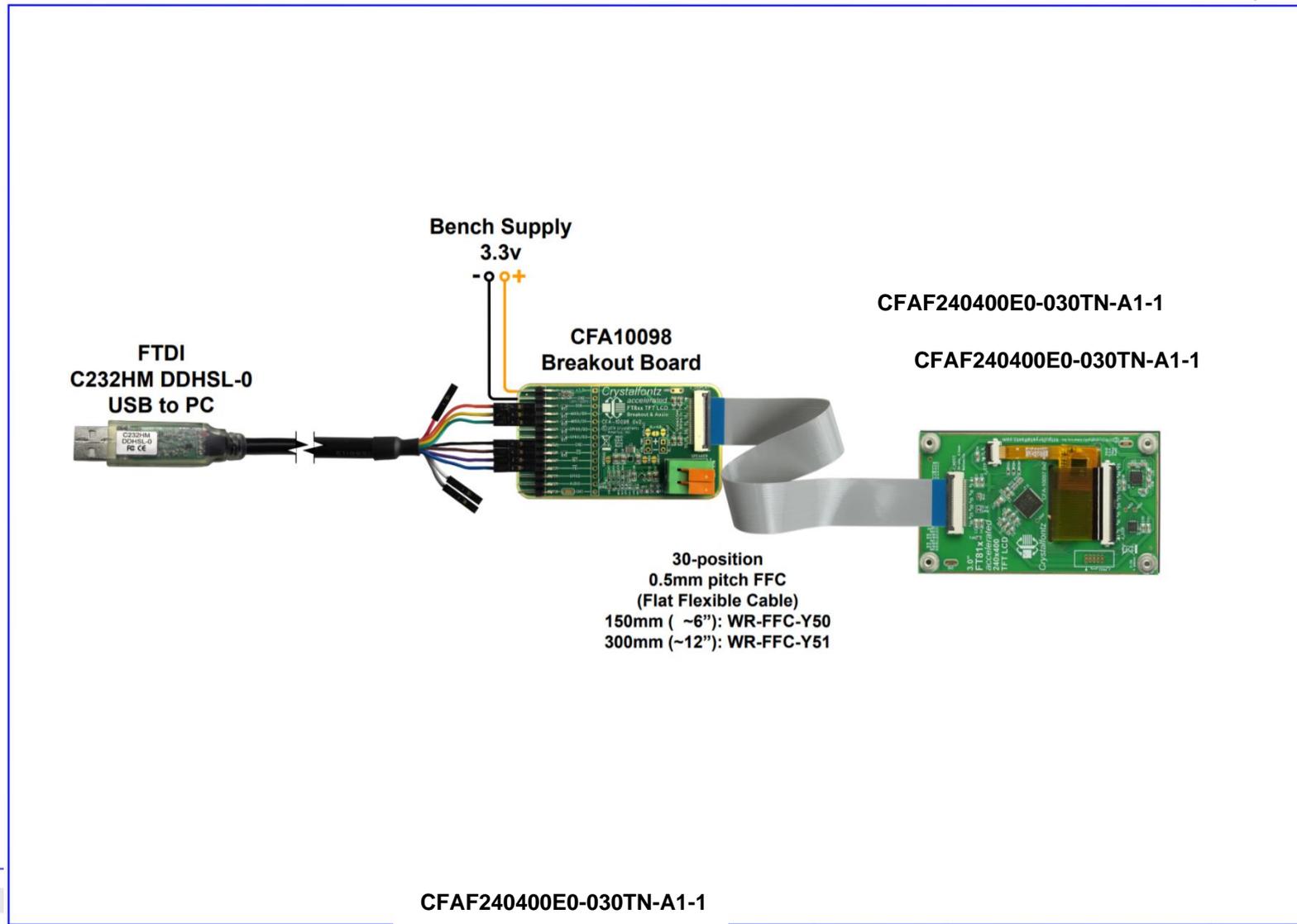
- Crystalfontz [CFAF240400E0-030-TN-A1-1](#) display module
- Appropriate ZIF connector: 30-position, 0,5mm pitch, tin contact mounted to your custom PCB
- Appropriate flat-flex-cable (6" [WR-FFC-Y50](#) & 12" [WR-FFC-Y51](#))

Procedure:

- Connect the FFC to the ZIF connector on your PCB
- Connect the FFC to the ZIF connector on the CFAF240400E0-030TN-A1-1 FFC (see the 7.6 below)
Note that your power supply must be able to supply enough current to drive the backlight.



7.5. Example Connection Diagrams



CFAF240400E0-030TN-A1-1

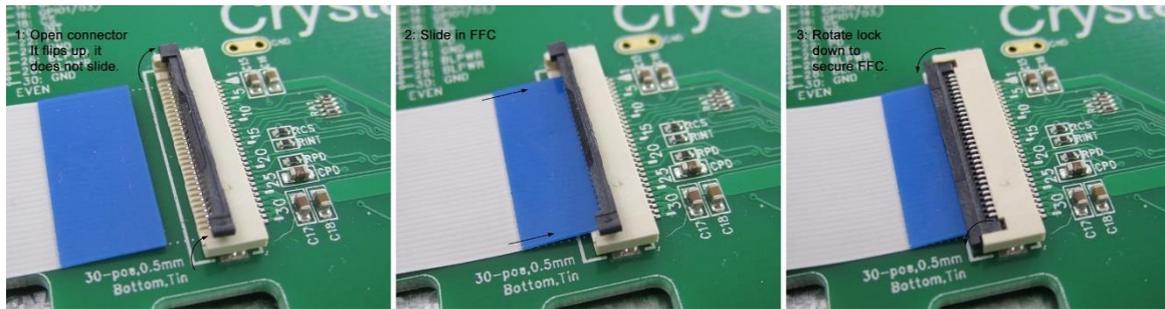


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7.6. ZIF Connector Use With Flat-Flex-Cable (FFC)

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



7.7. Troubleshooting

The CFAF240400E0-030TN-A1-1 ships with jumper JTEST opened. When JTEST is open, the TFT will initialize to black and the backlight will be off until VSYNC activity is detected. Closing the jumper will cause the TFT to initialize to a boot screen with the backlight on until VSYNC activity is detected.

Reach out to our support team at support@crystalfontz.com for further troubleshooting help.



8. Care and Handling Precautions

For optimum operation of the CFAF240400E0-030TN-A1-1, 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 outdated Crystalfontz modules at an approved facility.