



## 128 x 64 Graphic Display Module with Carrier Board

### DATASHEET



**CFAG12864U3-TFH-E1-1**

Datasheet Release: 2021-03-03

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## 1. General Information

### Datasheet Revision History

Datasheet Release: 2021-03-03  
Datasheet for the CFAG12864U3-TFH-E1-1 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. Introduction

The CFAG12864U3-TFH-E1-1 is a 2.2-inch, 128x64 graphic LCD display module with a backlight. It is small, thin, and very low-power. This display is visible in most lighting situations, including normal office lighting and bright sunlight. Use the backlight to make this display viewable in dark environments. This display is well suited for low-power hand-held devices that transition between well-lit and dark environments.

This LCD display has an integrated controller ([Sitronix ST7565P LCD driver](#)) and voltage generating components mounted on the flexible tail. The carrier board for this display module breaks the ZIF tail out to a 16-pin 0.1" (2.54mm) header.

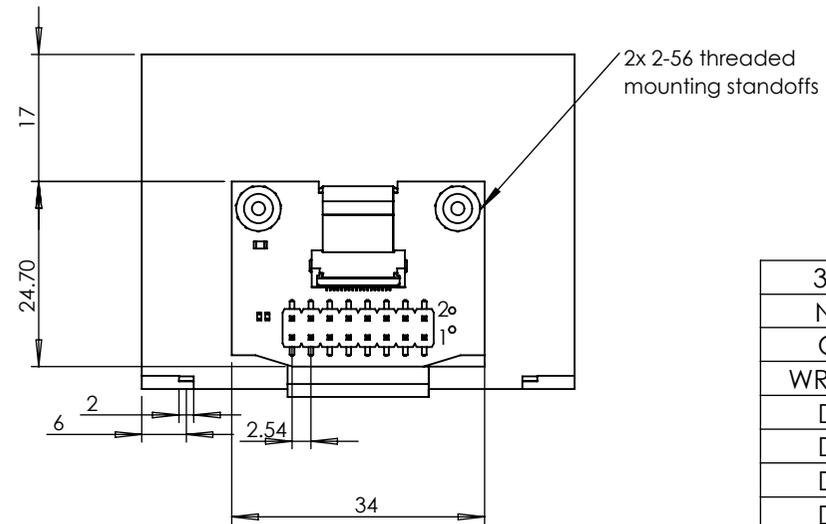
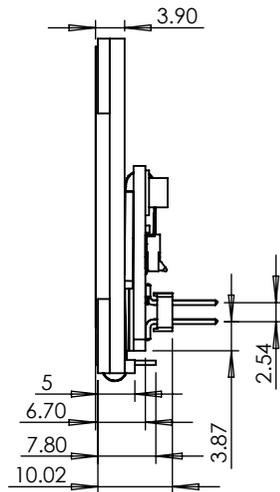
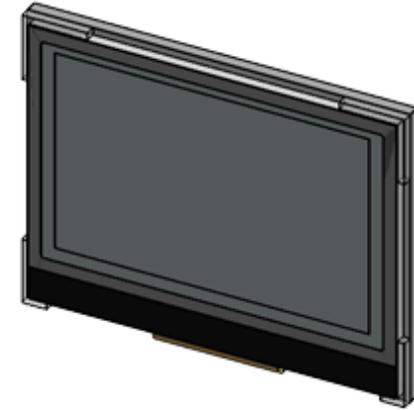
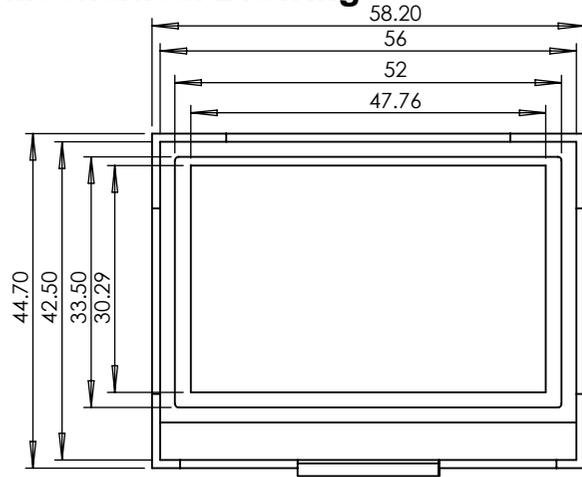
## 3. Features

- 2.2-inch 128 x 64 graphic LCD display module mounted on a carrier board
- Simple 4-wire SPI or 8-bit parallel interface
- Ultra-low power consumption
- Wide operating temperature range: -20°C to 70°C (-4°F to 158°F)

## 4. Mechanical Data

Item	Specification (mm)	Specification (inch)
Overall Module Dimension	58.2 (W) x 44.7 (H) x 10 (D)	2.29 (W) x 1.76 (H) x 0.39 (D)
Viewing Area	52.0 (W) x 33.5(H)	2.05 (W) x 1.32 (H)
Active Area	47.76 (W) x 30.29 (H)	1.88 (W) x 1.19 (H)
Dot Pitch	0.42 (W) x 0.37 (H)	0.017 (W) x 0.015 (H)
Weight (Typical)	19.5 grams	0.69 ounces

# 5. Mechanical Drawing



2	1
3v3	GND
NC	RES
CS	DC
WR/RW	RD/E
D1	D0
D3	D2
D5	D4
D7	D6

Units: millimeters  
Tolerance: ±0.3



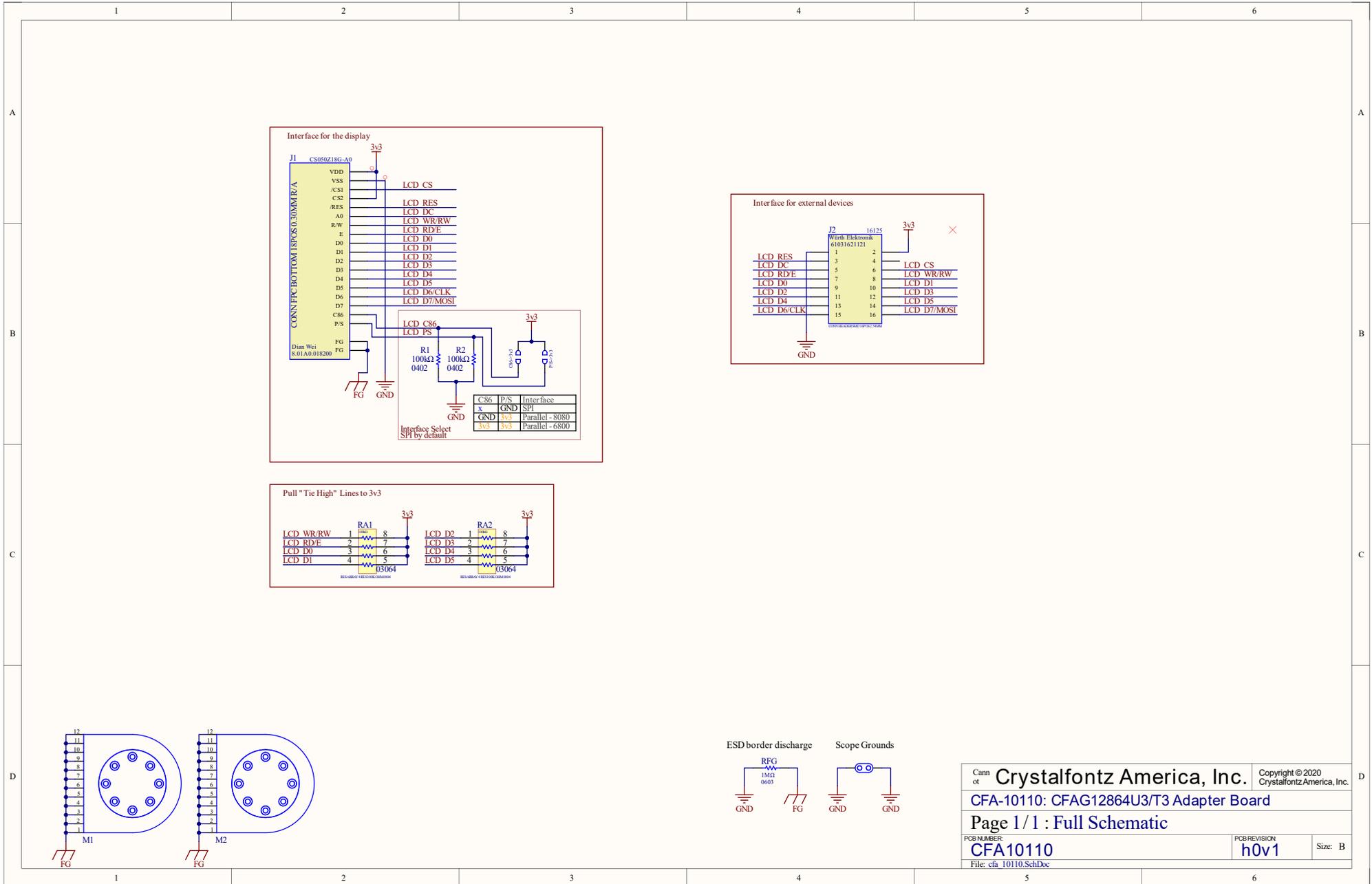
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Part Number:  
**CFAG12864U3TFH-E1-1**

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Web: www.crystalfontz.com/product/cfag12864u3tfe11

Revision: v1.0  
Sheet: 1 of 1

# 7. Schematic



Conn ot	<b>Crystalfontz America, Inc.</b>	Copyright © 2020 Crystalfontz America, Inc.
<b>CFA-10110: CFAG12864U3/T3 Adapter Board</b>		
<b>Page 1 / 1 : Full Schematic</b>		
PCB NUMBER: <b>CFA10110</b>	PCB REVISION: <b>h0v1</b>	Size: B
File: cfa_10110.SchDoc		



## 8. LCD Module

### 8.1. General Information

The CFAG12864U3-TFH-E1-1 module uses a Sitronix ST7565P LCD driver. For detailed information on this controller IC, see the ST7565P datasheet: [www.crystalfontz.com/controllers/Sitronix/ST7565P](http://www.crystalfontz.com/controllers/Sitronix/ST7565P)

### 8.2. Interface Pin Function

Pin	Symbol	4-wire SPI Interface	6800 Parallel Interface	8080 Parallel Interface
1	GND	System Ground		
2	3v3	Power Supply		
3	RES	Reset pin. Reset is executed when pin is pulled low.		
4	NC	Leave open		
5	DC	Data/Command Pin. When high, data bus is interpreted as data. When low, data bus is interpreted as a command.		
6	CS	Chip Select Pin. Chip is selected when pin is pulled low.		
7	RD/E	Not Used (fix to "H")	Read / Write Select	Write Enable (active low)
8	WR/RW	Not Used (fix to "H")	Read / Write Enable	Read Enable (active low)
9 – 14	D0 – D5	Not Used (fix to "H")	8-bit Bi-Directional Data Bus	
15	D6	SPI Serial Clock Input		
16	D7	SPI Serial Data Input		

Notes:

- The 4-wire SPI serial interface is write-only at all times.

### 8.3. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Logic Power Supply	3v3	-0.3	3.6	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

### 8.4. Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit
Logic Power Supply	3v3	3.0	3.3	3.3	V
Input Logic High	V <sub>IH</sub>	0.8 * (3v3)	-	3v3	V
Input Logic Low	V <sub>IL</sub>	0	-	0.2 * (3v3)	V
Logic Supply Current	I <sub>3v3</sub>	-	1.0	2.0	mA



### 8.5. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Response Time	$T_r$	25°C	-	200	300	ms
	$T_f$		-	250	350	ms
Contrast Ratio	CR	$\theta=0^\circ$	-	5	-	-
Viewing Angle	$\Theta 180^\circ$	$CR \geq 2$	0	-	30	Degree
	$\Theta 0^\circ$		0	-	60	
	$\Theta 90^\circ$		0	-	45	
	$\Theta 270^\circ$		0	-	45	
Viewing Direction	6 o'clock					

### 8.6. Backlight Characteristics

Item	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	VLED		-	3.5	-	V
Supply Current	ILED	$V_F=3.5V$	36	48	60	mA
LED Lifetime		$I_{LED}=48mA$ @ 25°C	-	30000	-	hours (estimated)
Luminance	IV	$I_{LED}=48mA$	688	860	-	cd/m <sup>2</sup>

Notes:

- Backlight is drive by current. Voltage is for reference only.
- Backlight power is provided via the A and K tabs on the back of the display

## 9. LCD Module Precautions

The precautions below should be followed when using LCD modules to help ensure personal safety, module performance, and compliance of environmental regulations.

### 9.1. Modules

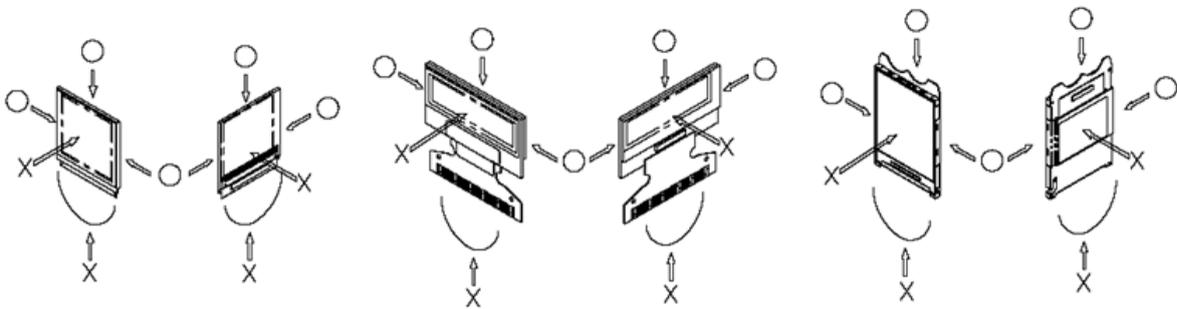
- Avoid applying excessive shocks to module or making any alterations or modifications to it.
- Do not make extra holes on the printed circuit board, modify its shape or change the components of LCD display module.
- Do not disassemble the LCD display module.
- Do not operate the LCD display module above the absolute maximum rating.
- Do not drop, bend or twist the LCD display module.
- Soldering: only to the I/O terminals.
- Store in an anti-static electricity container and clean environment.
- It is common to use the "screen saver" to extend the lifetime of the LCD display module.
  - Do not use the fixed information for long periods of time in real application.
  - Do not use fixed information in LCD panel for long periods of time to extend "screen burn" effect time.
- 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.

### 9.2. Handling Precautions

- The display panel is made of glass. Do not apply mechanical impacts.



- If the display panel is accidentally broken, and the internal organic substance leaks out, be careful not to inhale or touch the organic substance.
- If pressure is applied to the display surface or its neighborhood of the LCD display module, the cell structure may be damaged, so be careful not to apply pressure to these sections.
- The polarizer covering the surface of the LCD display module is soft and can be easily scratched. Please be careful when handling the LCD display module.
- Clean the surface of the polarizer covering the LCD display module if it becomes soiled using following adhesion tape.
  - Scotch Mending Tape No. 810 or an equivalent
  - Never breathe the soiled surface or wipe the surface using a cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.
  - The following liquids/solvents may spoil the polarizer:
    - Water
    - Ketone
    - Aromatic Solvents
- Hold the LCD display module very carefully when placing the LCD display module into the system housing.
- Do not apply excessive stress or pressure to the LCD display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, be sure to secure the sufficient rigidity for the outer cases.



- Do not apply stress to the LSI chips and the surrounding molded sections.
- Do not disassemble or modify the LCD display module.
- Do not apply input signals while the logic power is off.
- Pay sufficient attention to the working environments when handing the LCD display module to prevent occurrence of element breakage accidents by static electricity.
  - Be sure to make human body grounding when handling LCD display modules.
  - Be sure to ground tools to use for assembly such as soldering irons.
  - To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
  - Protective film is being applied to the surface of the display panel of the LCD display module. Be careful since static electricity may be generated when exfoliating the protective film.
- Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, 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 by the method discussed above.
- If electric current is applied when the LCD display module is being dewed or when it is placed under high humidity environments, the electrodes may become corroded. If this happens proceed with caution when handling the LCD display module.

### 9.3. Storing Precautions

- When storing the LCD display modules put them in static electricity preventive bags to avoid exposure to direct sunlight and fluorescent lamps. Also avoid high temperature and high humidity environments and low temperatures (less than 0°C) environments. (We recommend you store these modules in the packaged state when they were shipped from Crystalfontz). Be careful not to let water drops adhere to the packages or bags, and do not let dew gather on them.



- If electric current is applied when water drops are adhering to the surface of the LCD display module the LCD display module may have become dewed. If a dewed LCD display module is placed under high humidity environments it may cause the electrodes to become corroded. If this happens proceed with caution when handling the LCD display module.

#### 9.4. Designing Precautions

- The absolute maximum ratings are the ratings that cannot be exceeded for LCD display module. If these values are exceeded, panel damage may happen.
- To prevent occurrence of malfunctioning by noise pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.
- We recommend that you install excess current preventive unit (fuses, etc.) to the power circuit (VDD). (Recommend value: 0.5A)
- Avoid occurrence of mutual noise interference with the neighboring devices.
- As for EMI, take necessary measures on the equipment side.
- 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.

#### 9.5. Disposing Precautions

- Request qualified companies handle the industrial waste when disposing of the LCD display modules. Or, when burning them, observe the environmental and hygienic laws and regulations.

#### 9.6. 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 being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, 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.
- Periodical 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:

