



GRAPHIC LCD MODULE DATASHEET



Datasheet Release Date 2017-09-21
for

CFA012864D3 Series

- **CFA012864D3-TFH**
- **CFA012864D3-TMI**

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1. General Information

Datasheet Revision History

Datasheet Release: **2017-09-21**

Datasheet for the CFAO12864D3 Series graphic LCD 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

These graphic LCD display modules use very low power consumption. These displays have a built-in Sitronix ST7565P controller.

Please see [Sitronix ST7565P LCD Controller Datasheet](#) for further reference.

3. Color Variants

- **CFAO12864D3-TFH**: Dark (near black) characters on a light-gray background with a white LED backlight.
- **CFAO12864D3-TMI**: Light (near white) characters on a blue background with a white LED backlight.

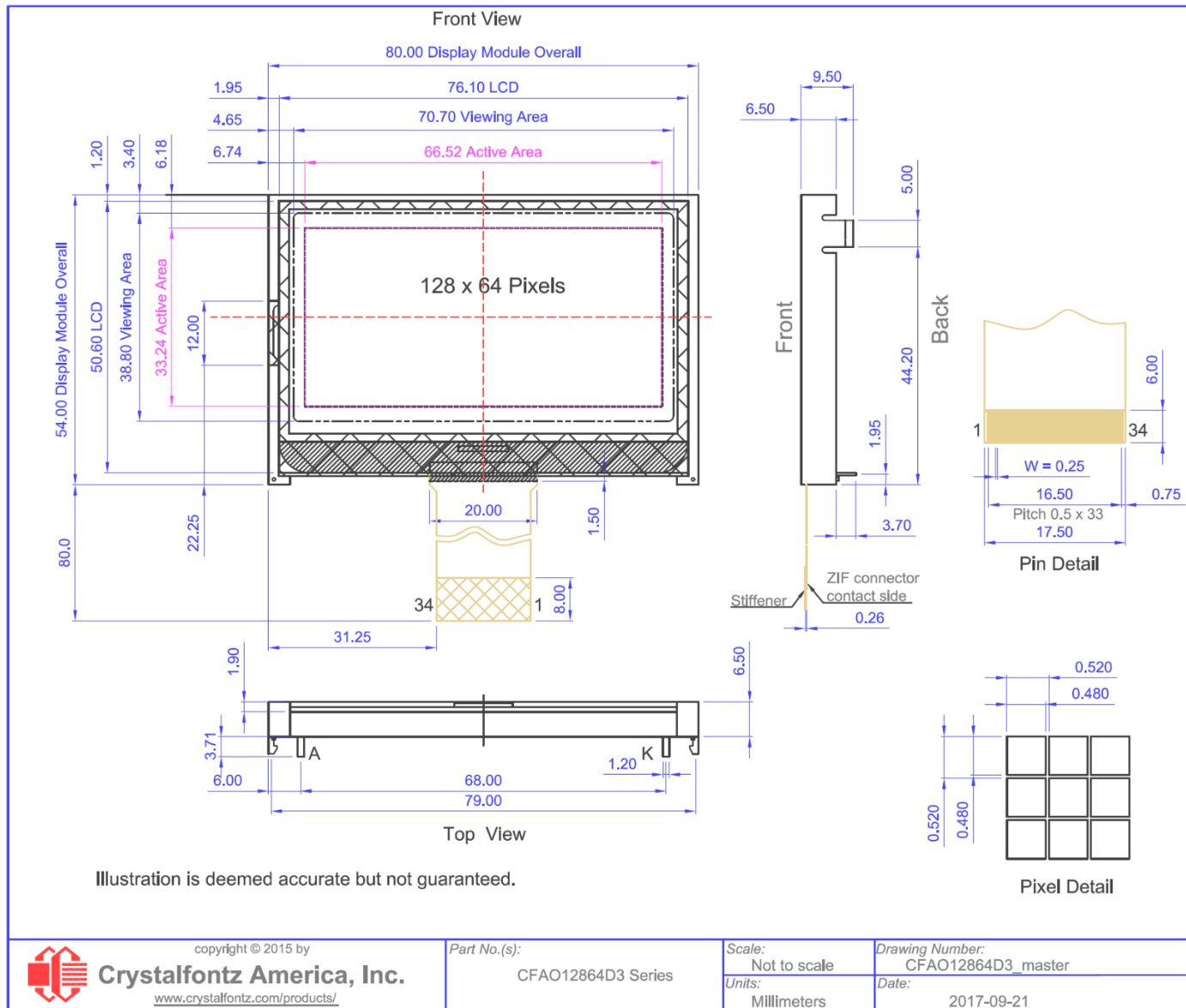
4. Features

- 128*64 Dot Matrix
- Built-in Controller ST7565P (or equivalent)
- Viewing Direction: 6 o'clock
- +5V Power Supply
- Operating Temperature: -20°C to +70°C
- 1/64 Duty, 1/9 Bias
- Interface: 8-Bit Parallel / SPI

5. Mechanical Data

Item	Specification (mm)	Specification (inch, reference)
Overall Width and Height	80.0 (W) x 54.0 (H) x 9.5 (D)	3.149 (W) x 2.126 (H) x 0.374 (D)
Viewing Area	70.7 (W) x 38.8 (H)	2.783 (W) x 1.528 (H)
Active Area	66.52 (W) x 33.24 (H)	2.619 (W) x 1.309 (H)
Dot Size	0.48 (W) x 0.48 (H)	0.019 (W) x 0.019 (H)
Dot Pitch	0.52 (W) x 0.52 (H)	0.020 (W) x 0.020 (H)
Weight (Typical)	40 grams	1.41 ounces

6. Mechanical Drawing



7. Interface Pin Function

Pin No.	Symbol	Level	Function
1	/CS1	I	Chip Select Signal
2	/RES	I	Reset Signal
3	A0	I	This is connected to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or command. A0=H: Indicates that D0-D7 are display data. A0=L: Indicates that D0-D7 are control data.
4	/WR(R/W)	I	When connected to 8080 series MPU, this pin is treated as the /WR signal of the 8080 MPU and is active low. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to 6800 series MPU, this pin is treated as the R/W signal of the 6800 MPU and decides the access type: When R/W = H: Read When R/W=L: Write
5	/RD(E)	I	When connected to 8080 series MPU, this pin is treated as the /RD signal of the 8080 MPU and is active low. The data bus is in an output status when this signal is "L". When connected to 6800 series MPU, this pin is treated as the "E" signal of the 6800 MPU and is active high. This is the enable clock input terminal of the 6800 series MPU.
6-13	DB0-DB7	I/O	Data bus lines
14	V _{DD}	-	Supply Voltage for Logic
15	V _{SS}	-	Ground
16	V _{OUT}	O	DC/DC voltage converter. Connect a capacitor between this terminal and V _{SS} or V _{DD} .
17	CAP5+	O	DC/DC Voltage Converter
18	CAP3+		
19	CAP1-		
20	CAP1+		
21	CAP2+		
22	CAP2-		
23	CAP4+		
24	VRS	-	This is the internal output VREG power supply for the LCD power supply voltage regulator.
25	V4	-	This is the multi-level power supply for the liquid crystal drive.
26	V3		
27	V2		
28	V1		
29	V0		
30	VR	I	Output voltage regulator terminal. Provides the voltage between V _{SS} and dV0 through a resistive voltage divider. IRS=L: the V0 voltage regulator internal resistors are not used. IRS=H: the V0 voltage regulator internal resistors are used.

Pin No.	Symbol	Level	Function															
31	C86	I	This is the MPU interface selection pin. C86=H: 6800 series MPU interface. C86=L: 8080 series MPU interface.															
32	P/S	I	This is the parallel data input/serial data input switch terminal. P/S=H: Parallel data input P/S=L: Serial data input The following applies depending on the P/S status: <table border="1" data-bbox="625 517 1401 613"> <thead> <tr> <th>P/S</th> <th>Data/Command</th> <th>Data</th> <th>Read/Write</th> <th>Serial Clock</th> </tr> </thead> <tbody> <tr> <td>H</td> <td>A0</td> <td>D0-D7</td> <td>/RD, /WR</td> <td>X</td> </tr> <tr> <td>L</td> <td>A0</td> <td>SI (D7)</td> <td>Write Only</td> <td>SCL (D6)</td> </tr> </tbody> </table>	P/S	Data/Command	Data	Read/Write	Serial Clock	H	A0	D0-D7	/RD, /WR	X	L	A0	SI (D7)	Write Only	SCL (D6)
P/S	Data/Command	Data	Read/Write	Serial Clock														
H	A0	D0-D7	/RD, /WR	X														
L	A0	SI (D7)	Write Only	SCL (D6)														
33	/HPM	I	This is the power control terminal for the power supply circuit for the liquid crystal drive. /HPM=H: Normal Mode /HPM=L: High Power Mode															
34	IRS	I	This terminal selects the resistors for the V ₀ voltage level adjustment. IRS=H: Use the internal resistors IRS=L: Do not use the internal resistors. The V ₀ voltage level is regulated by an external resistive voltage divider attached to the VR terminal.															

8. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Notes
Power Supply Voltage	V _{DD}	-0.3	3.6	V	(1)(2)
Power Supply Voltage (V _{DD} standard)	V ₀ , V _{OUT}	-0.3	14.5	V	(1)(2)
Power Supply Voltage (V _{DD} standard)	V1, V2, V3, V4	-0.3	V ₀ +0.3	V	(1)(2)
Input Voltage	V _I	0	V _{DD} +0.3	V	-
Operating Temperature	T _{OP}	-20	+70	°C	-
Storage Temperature	T _{ST}	-30	+80	°C	-

Notes:

- (1) These are stress ratings only. Extended exposure to the absolute maximum ratings listed above may affect device reliability or cause permanent damage.
- (2) Functional operation should be restricted to the limits in the Electrical Characteristics table below.

9. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	$V_{DD} - V_{SS}$	-	2.7	-	3.3	V
Supply Voltage for LCM	$V_0 - V_{SS}$	Ta=-20°C	10.0	10.2	10.4	V
		Ta=25°C	9.8	10.0	10.2	V
		Ta=70°C	9.6	9.8	10.0	V
High-level Input	V_{IH}	-	0.8 V_{DD}	-	V_{DD}	V
Low-level Input	V_{IL}	-	V_{SS}	-	0.2 V_{DD}	V
High-level Output	V_{OH}	-	0.8 V_{DD}	-	V_{DD}	V
Low-level Output	V_{OL}	-	V_{SS}	-	0.2 V_{DD}	V
Supply Current (without backlights)	I_{DD}	-	-	0.6	1	mA

10. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ	CR \geq 2	0	-	30	$\phi = 180^\circ$
	θ	CR \geq 2	0	-	60	$\phi = 0^\circ$
	θ	CR \geq 2	0	-	45	$\phi = 90^\circ$
	θ	CR \geq 2	0	-	45	$\phi = 270^\circ$
Contrast Ratio	CR	-	-	5	-	-
Response Time	T rise	-	-	200	300	ms
	T fall	-	-	250	350	ms

11. Backlight Information

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Notes
Supply Current	I_{LED}	V=3.5v	-	96	120	mA	(1)(2)
Supply Voltage	V	-	3.4	3.5	3.6	V	-
Reverse Voltage	V_R	-	-	-	5	V	-
Luminance (without LCD)	I_v	$I_{LED}=96mA$	840	1050	-	cd/m ²	-
LED Lifetime	-	$I_{LED}=96mA$ 25°C, 50- 60% RH	-	50K	-	Hrs.	(1)(2)
Color	White						

Notes:

- (1) Supply current minimum value is only for reference since the LED brightness efficiency keeps enhancing. Current consumption becomes less and less to achieve the same luminance.
- (2) Lifetime is defined as the amount of time when the luminance has decayed to <50% of the initial value (50K hours is an estimate for reference only).

12. LCD Module Precautions

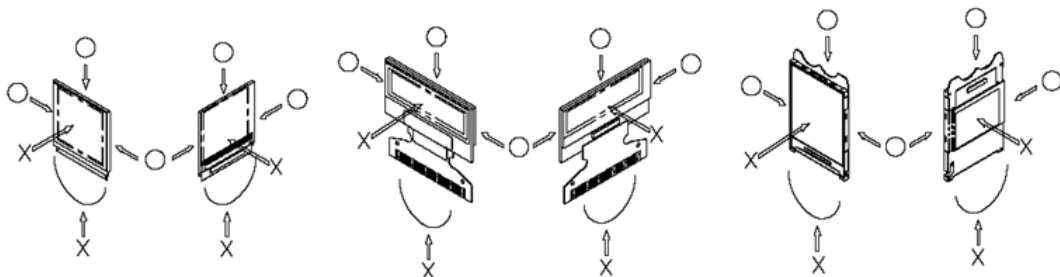
The precautions below should be followed when using LCD modules to help ensure personal safety, module performance, and compliance of environmental regulations.

12.1. 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 the passive components, including R3, R6 & backlight adjust resistors. (Resistors, capacitors and other passive components will have different appearance and color caused by the different supplier.)
- Crystalfontz have the right to change the PCB Rev. (In order to satisfy the supplying stability, management optimization and the best product performance, etc., under the premise of not affecting the electrical characteristics and external dimensions, Crystalfontz has the right to modify the version.)

12.2. Handling Precautions

- Since the display panel is made of glass, do not apply mechanical impacts such as dropping from a high position.
- 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.

12.3. Storage 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.

12.4. 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 V_{IL} and V_{IH} 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 (V_{DD}). (Recommend value: 0.5A)
- Pay sufficient attention to 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.

12.5. Disposing Precautions

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

12.6. 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.
 - Design the product and installation method so that the LCD driver may be shielded from light 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.
- We recommend that you construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of 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:

