Crystalfontz

CHARACTER LCD MODULE DATASHEET

CFAH4004A1-YYH-JT

Release Date 2024-01-23

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CONTENTS

1. General Information

Datasheet Revision History
Datasheet Release: **2024-01-23** Datasheet for the CFAH4004A1-YYH-JT character 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

This is a 40 character by 4-line yellow-green LCD display with a yellow-green LED backlight. This display has a built-in Sitronix ST7066U controller. The Sitronix ST7066U is compatible with the industry standard Hitachi HD44780 controller.

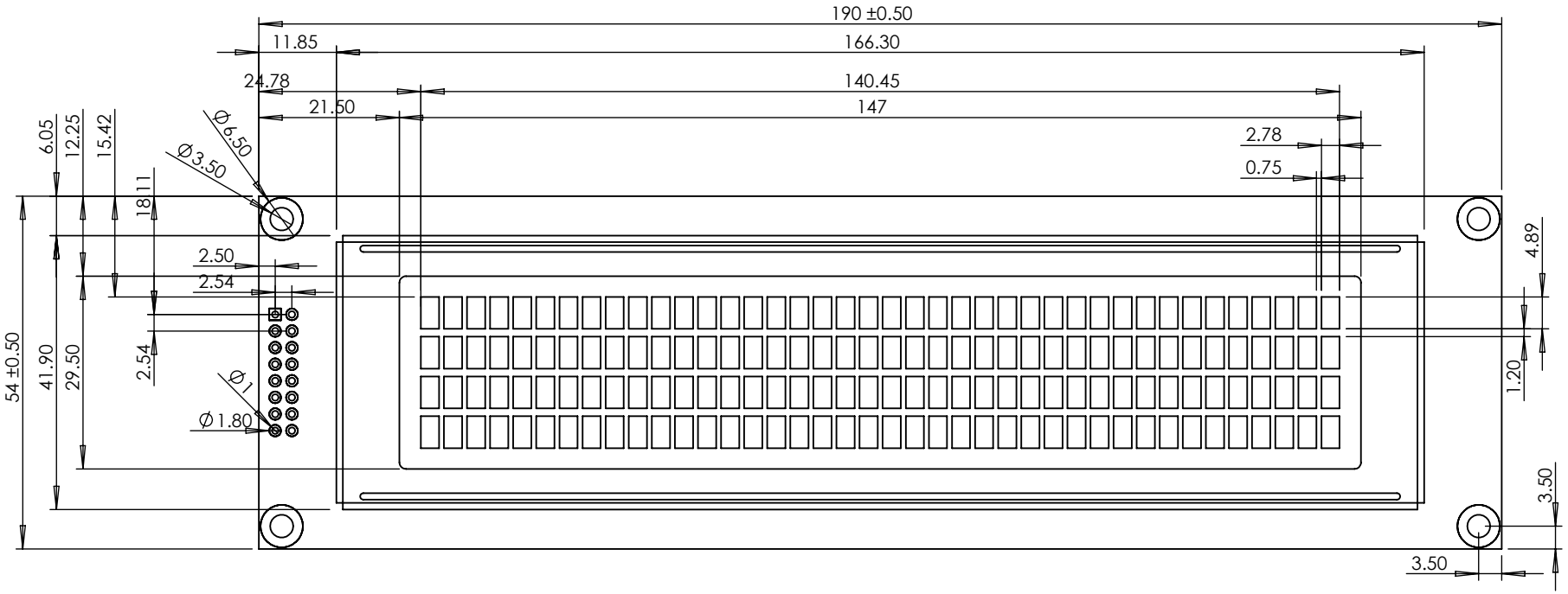
Please see Sitronix ST7066U LCD Controller Datasheet for further reference.

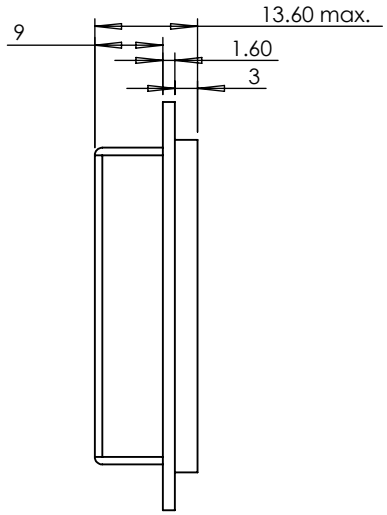
3. Features

- Built-in Controller: ST7066 (or equivalent)
- Yellow Green LED Backlight
- STN Positive, Gray, Transflective Mode
- 5v Power Supply
- Viewing Direction: 6 o'clock
- 1/16 Duty
- Temperature Operation: -20°C to +70°C
- Interface: 4-Bit or 8-Bit 6800 Parallel

4. Mechanical Data

Item	Specification (mm)	Specification (inch, reference)
Overall Width and Height	190.0 (W) x 54.0 (H) x 13.6 (D)	7.48 (W) x 2.13 (H) x 0.54 (D)
Viewing Area	147.0 (W) x 29.5 (H)	5.79 (W) x 1.16 (H)
Active Area	140.45 (W) x 23.16 (H)	5.53 (W) x 0.91 (H)
Character Size	2.78 (W) x 4.89 (H)	0.11 (W) x 0.19 (H)
Character Pitch	3.53 (W) x 6.09 (H)	0.14 (W) x 0.24 (H)
Dot Size	0.50 (W) x 0.55 (H)	0.02 (W) x 0.02 (H)
Dot Pitch	0.57 (W) x 0.62 (H)	0.02 (W) x 0.02 (H)
Weight (Typical)	130 grams	4.6 ounces





Display Controller	ST7066U
LED Brightness	580
Viewing Direction	6:00
Operating Temperature	-20 to 70 °C
Voltage Levels	5v

Pin	Function
1	DB7
2	DB6
3	DB5
4	DB4
5	DB3
6	DB2
7	DB1
8	DB0
9	E1
10	R/W
11	RS
12	VO
13	VSS
14	VDD
15	E2
16	NC
17	A
18	K

Units: millimeters
Tolerance: ±0.3

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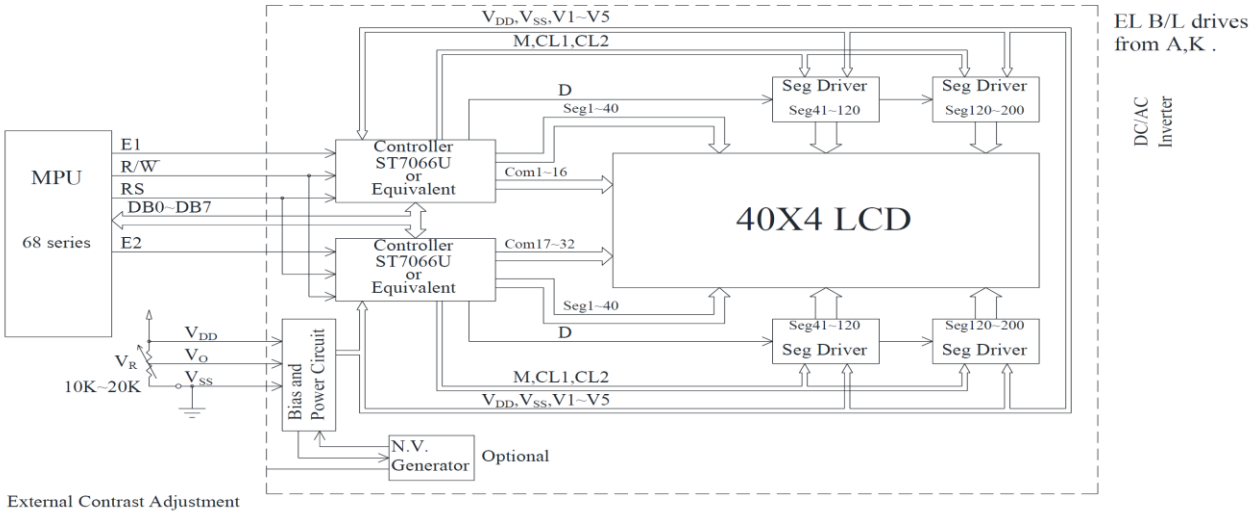
Part Number:	Date:	Filename:	Revision:
CFAH4004A1-TMI-JT	7/19/2023	CFAH4004A1 mm.pdf	v1.0
	Web: www.crystalfontz.com/productCFAH4004A1		Sheet: 1 of 1

6. Interface Pin Function

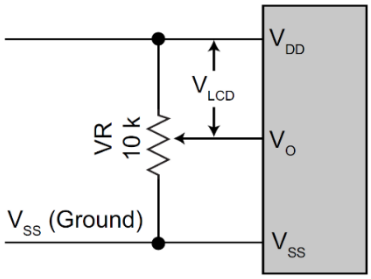
Pin No.	Symbol	Level	Function
1	DB7	H/L	Data Bus Line
2	DB6	H/L	Data Bus Line
3	DB5	H/L	Data Bus Line
4	DB4	H/L	Data Bus Line
5	DB3	H/L	Data Bus Line
6	DB2	H/L	Data Bus Line
7	DB1	H/L	Data Bus Line
8	DB0	H/L	Data Bus Line
9	E1	H, H→L	Chip Enable Signal for upper lines
10	R/W	H/L	H: Read (Module → MPU) L: Write (MPU → Module)
11	RS	H/L	H: Data L: Instruction Code
12	V_O	(variable)	Supply Voltage for LCD
13	V_{SS}	0v	Ground
14	V_{DD}	5.0v	Supply Voltage for Logic
15	E2	H, H→L	Chip Enable Signal for lower lines
16	NC	-	No Connection
17	A	-	Power Supply for LED (+)
18	K	-	Power Supply for LED (-)

7. System Block Diagram



7.1. V_O Connection for Display Contrast

Crystalfontz recommends allowing field adjustment of V_O for all designs. The optimal value of V_O varies with temperature, variations in V_{DD}, and viewing angle. V_O will also vary module-to-module and batch-to-batch due to normal manufacturing variations. If exposing adjustments to V_O is not possible, Crystalfontz recommends enabling adjustment of V_O as part of a product's final test.



Although a potentiometer is shown as a typical connection, V_O can be driven by a microcontroller, using either a DAC or a filtered PWM. Displays that require V_O to be negative may require a level shifting circuit.

Start with an initial value of V_O = +0.65v, (V_{LCD} = +4.35v), and adjust from there.

8. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	V_{DD} -V_{SS}	-0.3	7	V	(1)(2)
Supply Voltage for LCD	V_{DD} -V_O	-0.3	13	V	(1)(2)
Input Voltage	V_I	V_{SS}	V_{DD}	V	-
Operating Temperature	T_{OP}	-20	+70	°C	-
Storage Temperature	T_{ST}	-30	+80	°C	-

Note: These are stress ratings only. Extended exposure to the ratings listed above may affect device reliability or cause permanent damage. 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}	-	4.5	5.0	5.5	V
Supply Voltage for LCD	V_{DD} -V_O	Ta=-20°C	-	-	5.7	V
		Ta=25°C	4.2	4.35	4.5	V
		Ta=70°C	3.8	-	-	V
High-level Input	V_{IH}	-	0.7 V_{DD}	-	V_{DD}	V
Low-level Input	V_{IL}	-	V_{SS}	-	0.6	V
High-level Output	V_{OH}	-	3.9	-	V_{DD}	V
Low-level Output	V_{OL}	-	0	-	0.4	V
Supply Current	I_{DD}	V_{DD} = 5.0V	1.8	3.5	7.0	mA

10. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ	CR≥2	0	-	20	ϕ = 180°
	θ	CR≥2	0	-	40	ϕ = 0°
	θ	CR≥2	0	-	30	ϕ = 90°
	θ	CR≥2	0	-	30	ϕ = 270°
Contrast Ratio	CR	-	-	3	-	-
Response Time	T rise	-	-	150	200	ms
	T fall	-	-	150	200	ms

11. Backlight Information

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Notes
Supply Current	I_{LED}	V=4.2v	300	600	720	mA	(1)(2)
Supply Voltage	V	-	3.85	4.2	4.35	V	(3)
Reverse Voltage	V_R	-	-	-	8	V	-
Luminance (without LCD)	I_V	I_{LED}=600mA	210	260	-	cd/m^2	-
LED Lifetime	-	I_{LED}=600mA 25°C, 50-60% RH	-	100K	-	Hrs.	(1)(2)
Color	Yellow Green						

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).
(3) LEDs are current driven devices. Supply voltage is given for reference only.

12. DDRAM and CGROM Tables

Please see Sitronix ST7066U LCD Controller Datasheet for further reference.

12.1. Display Position DDRAM Address

The following table shows the relationship between the controller's addresses and the corresponding character location on the module

Upper 40x2 E1 = High

	1	2	3	4	5	6	7		35	36	37	38	39	40
DDRAM Address	00	01	02	03	04	05	06	....	22	23	24	25	26	27
DDRAM Address	40	41	42	43	44	45	46		62	63	64	65	66	67

Lower 40x2 E2 = High

	1	2	3	4	5	6	7		35	36	37	38	39	40
DDRAM Address	00	01	02	03	04	05	06	...	22	23	24	25	26	27
DDRAM Address	40	41	42	43	44	45	46		62	63	64	65	66	67

12.2. Character Generator ROM (CGROM)

Upper 4 bit / Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
LLLL	CG RAM (1)															
LLLH	(2)															
LLHL	(3)															
LLHH	(4)															
LHLL	(5)															
LHLH	(6)															
LHHL	(7)															
LHHH	(8)															
HLLL	(1)															
HLLH	(2)															
HLHL	(3)															
HLHH	(4)															
HHLL	(5)															
HHLH	(6)															
HHHL	(7)															
HHHH	(8)															

13. LCD Module Precautions

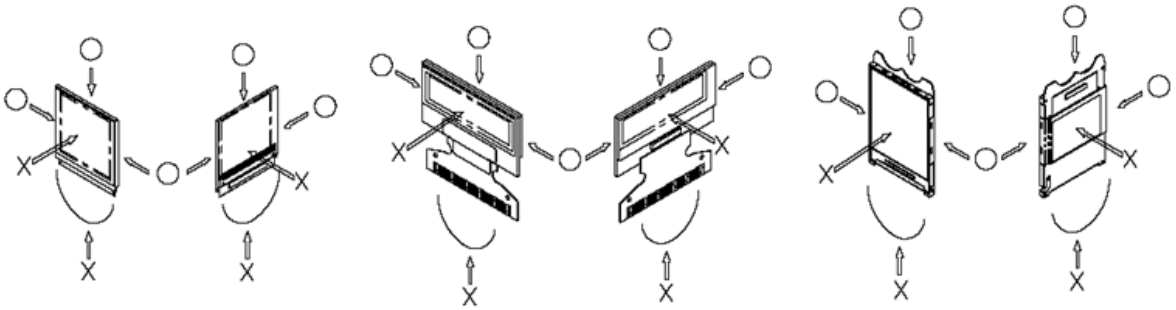
These precautions help ensure personal safety, module performance, and compliance of environmental regulations when using an LCD module.

13.1. Modules

- Avoid excessive physical and electrical shocks to module.
- Do not drop, bend, or twist the LCD display module.
- Do not make extra holes, modify the shape, or change the components of the printed circuit board.
- Do not disassemble the LCD display module.
- Do not operate the LCD display module outside the absolute maximum rating.
- Only solder to the I/O terminals.
- Store in an anti-static electricity container and clean environment.
- Do not display static information for long periods of time to avoid burn in.
- 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.

13.2. Handling Precautions

- The display panel is made of glass. Do not apply mechanical impacts, stress or pressure to the LCD display module.
- Pressure applied to or near the display surface may damage the cell structure.
- If the display panel is accidently broken and the internal organic substance leaks out, do not inhale or touch the organic substance.
- The polarizer covering the surface of the LCD display module is soft and can be easily scratched. Cover the polarizer in the final design.
- Clean the surface of the polarizer using Scotch Mending Tape No. 810 or an equivalent
  - Never breathe on the surface or wipe the surface using a cloth containing solvent such as ethyl alcohol, as the surface of the polarizer will become cloudy.
  - Water, ketone, and aromatic solvents may ruin the polarizer.
- Do not over bend the film with electrode pattern layouts. This can effect the display performance.



- Do not apply stress to the LSI chips and the surrounding molded sections.
- Do not apply input signals while the logic power is off.
- Prevent damage by electrostatic discharge (ESD) when handling the LCD display module:
  - Ground personnel handling LCD display modules.
  - Ground tools used for assembly such as soldering irons.
  - To suppress generation of ESD, avoid carrying out assembly work under dry environments.
  - Remove the protective film applied to the display panel slowly as ESD may be generated when removing the film.
- Protective film is applied to the surface of the display panel. Remove the film before assembly. 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 as discussed above.

13.3. Storing Precautions

- Store the LCD display modules in ESD preventative bags. Avoid exposure to direct sunlight and fluorescent lamps. Avoid high temperature and high humidity environments and low temperature (less than 0°C) environments. We recommend storing these modules in the packaged state in which they were shipped from Crystalfontz.
- Do not let water drops or dew adhere to the packages or bags.
- If electric current is applied when water is on the surface of the LCD display module, the module may become dewed. If a dewed LCD display module is placed under high humidity environments the electrodes may become corroded.

13.4. Designing Precautions

- The absolute maximum ratings cannot be exceeded for LCD display module. If these values are exceeded, panel damage may happen.
- Satisfy the VIL and VIH specifications and, ensure the signal line cable is as short as possible to avoid signal noise.
- Install excess current preventative unit (fuses, etc.) to the power circuit. Recommend value: 0.5A
- Avoid occurrence of mutual noise interference with the neighboring devices.
- 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.

13.5. Disposing Precautions

- Request qualified companies handle the industrial waste when disposing of the LCD display modules. Observe all relevant laws and regulations.

13.6. 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 exposed. 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.
- Periodically 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.