GRAPHIC LCD MODULE DATASHEET

CFAG12864Q1-TMI-E1

CFAG12864Q1-TFH-E1

Datasheet Release Date 2022-03-02
for
CFAG12864Q1-xxx-E1 Family

Crystalfontz America, Inc.
12412 East Saltese Avenue
Spokane Valley, WA 99216-0357
Phone: 888-206-9720
Fax: 509-892-1203
Email: support@crystalfontz.com
URL: www.crystalfontz.com

CONTENTS

2. General Information 3
3. Module Description 4
4. Features 4
5. Mechanical Data 4
6. Mechanical Drawing 5
7. Schematic 6
8. Jumper Locations and Functions 7
9. Interface Pin Function – JBREAKOUT (20-pin header) 8
10. Absolute Maximum Ratings 9
11. Electrical Characteristics 9
12. Optical Characteristics 9
13. Backlight Information 10
14. LCD Module Precautions 10

1. General Information

Datasheet Revision History
Datasheet Release: 2022-03-02 Datasheet for the CFAG12864Q1-xxx-E1 Arduino Shield display modules.

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.

Disclaimer
Certain applications using Crystalfontz America, Inc. products may involve potential risks of death, personal injury, or severe property or environmental damage ("Critical Applications"). CRYSTALFONTZ AMERICA, INC. PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. Inclusion of Crystalfontz America, Inc. products in such applications is understood to be fully at the risk of the customer. In order to minimize risks associated with customer applications, adequate design and operating safeguards should be provided by the customer to minimize inherent or procedural hazard. Please contact us if you have any questions concerning potential risk applications. Crystalfontz America, Inc. assumes no liability for applications assistance, customer product design, software performance, or infringements of patents or services described herein. Nor does Crystalfontz America, Inc. warrant or represent that any license, either express or implied, is granted under any patent right, copyright, or other intellectual property right of Crystalfontz America, Inc. covering or relating to any combination, machine, or process in which our products or services might be or are used. All specifications in datasheets on our website are, to the best of our knowledge, accurate but not guaranteed. Corrections to specifications are made as any inaccuracies are discovered. Company and product names mentioned in this publication are trademarks or registered trademarks of their respective owners. Copyright © 2022 by Crystalfontz America, Inc.,12412 East Saltese Avenue, Spokane Valley, WA 99216 U.S.A.

2. Module Description

These graphic LCD display modules comprise a graphic LCD screen mounted to a carrier board. These modules are designed for use with Arduino Uno form factor microcontrollers and simply press on to the Uno's ports. These modules can be powered from either 3.3v or 5v. The display is very low power consumption. These displays have a built-in Sitronix ST7567 controller.

Please see Sitronix ST7567 LCD Controller Datasheet for further reference.

CFAG12864Q1-xxx - E1-2
1 2 3 4 5 6 7

1. Crystalfontz
2. Graphic LCD
3. 128x64 resolution
4. Series name and revision number
5. TMI – White backlight, STN Negative, Blue, Transmissive
   TFH – White backlight, FSTN Negative, Black, Transflective
6. With Carrier Board
7. With Seeeduino

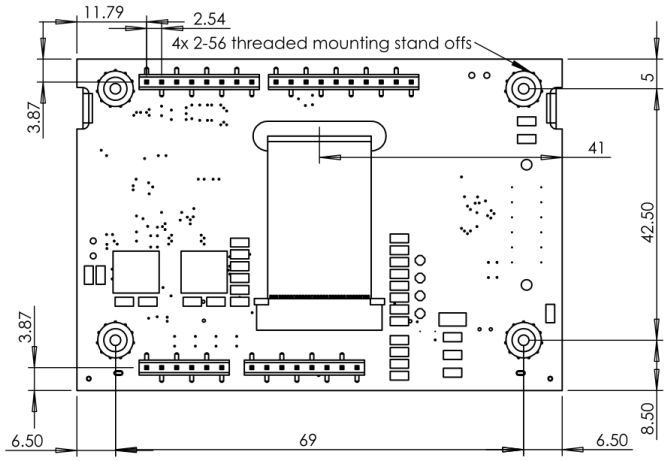
3. Features

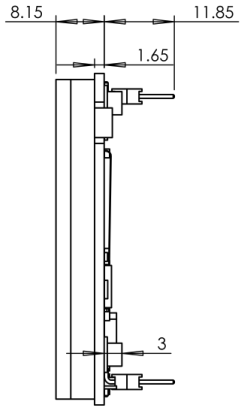
- 128*64 Dot Matrix
- Built-in Controller ST7567 (or equivalent)
- Viewing Direction: 6 o'clock
- +5V Power Supply
- Operating Temperature: -20°C to +70°C
- 1/65 Duty, 1/9 Bias
- Interface: 8-Bit Parallel, SPI

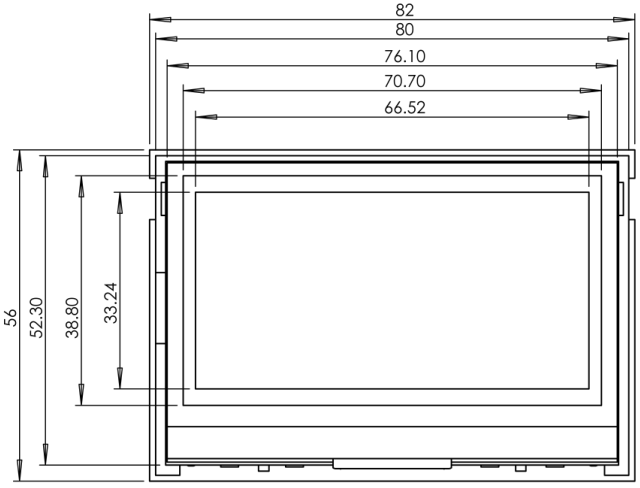
4. Mechanical Data

Item	Specification (mm)	Specification (inch, reference)
Overall Width and Height	82 (W) x 56 (H) x 11.5 (D)	3.23 (W) x 2.20 (H) x 0.44 (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)	58 grams	2 ounces

5. Mechanical Drawing







Display Controller	ST7567
Backlight Brightness	1050 cd/m2
Viewing Direction	6:00
Operating Temperature	-20 to 70 C
Voltage Levels	5v or 3.3v

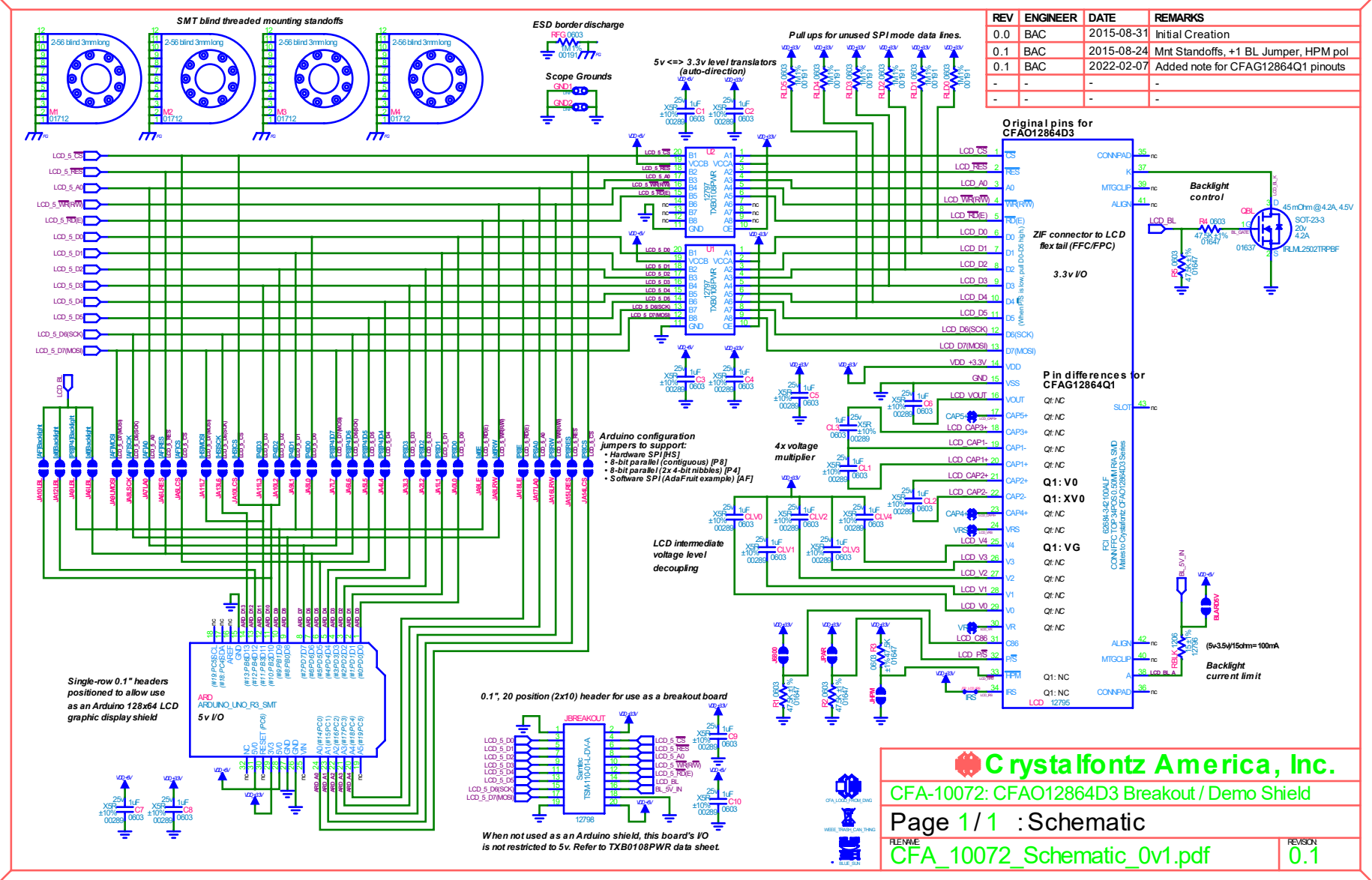
Note: this module comprises the CFAG12864Q1 module plus the CFA10072 breakout board and is designed to be pressed into an Arduino Uno style microcontroller.
The E1 in the part number indicates it is the display plus a carrier board. E1-2 indicates the display plus carrier board plus a Seeeduino microcontroller

Units: millimeters
Tolerance: ±0.3

Crystalfontz
© 2022 Crystalfontz America, Inc.

Part Number:	Date:	Filename:	Revision:
CFAG12864Q1-xxx-E1	2022-02-18	CFAG12864Q1-E1 mm.pdf	v1.0
	Web: www.crystalfontz.com/product/cfag12864q1tmie1		Sheet: 1 of 1

6. Schematic



REV	ENGINEER	DATE	REMARKS
0.0	BAC	2015-08-31	Initial Creation
0.1	BAC	2015-08-24	Mnt Standoffs, +1 BL Jumper, HPM pol
0.1	BAC	2022-02-07	Added note for CFAG12864Q1 pinouts
-	-	-	-
-	-	-	-

Crystalfontz America, Inc.
CFA-10072: CFAO12864D3 Breakout / Demo Shield
Page 1 / 1 : Schematic
FILENAME: CFA_10072_Schematic_0v1.pdf
REVISION: 0.1

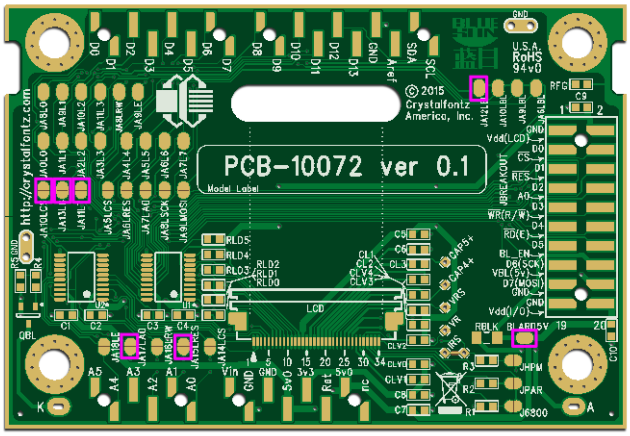
7. Jumper Locations and Functions

The CFA10072 breakout board offers support for a wide variety of configurations. The majority of the jumpers, named JA0L0 through JA18LE open or close specific connections between the display and the pin on the Arduino. In order for a connection to be achieved using the edge pins, the corresponding jumper must be closed.

7.1. As Shipped

The displays are shipped with the JA10LCS, JA13L6, JA11L7, JA17LA0, JA15LRES, JA12BL, and BLARD5V jumpers closed to set the display up for SPI.

JA10LCS connects the Arduino pin D10 to the display's pin 1, CS.
JA13L6 connects the Arduino pin D13 to the LCD's pin 12 SCK (D6).
JA11L7 connects the Arduino pin D11 to the LCD's pin 13, MOSI (D7).
JA17LA0 connects the Arduino pin D17 (A3) to the LCD's pin 3 A0 (Data/Command).
JA15LRES connects the Arduino pin D15 (A1) to the LCD's pin 2 RES.
JA12BL connects the Arduino pin D12 to the backlight control circuit on the breakout board.
BLARD5V connects the Arduino's 5v output to the backlight anode through a current limiting resistor.



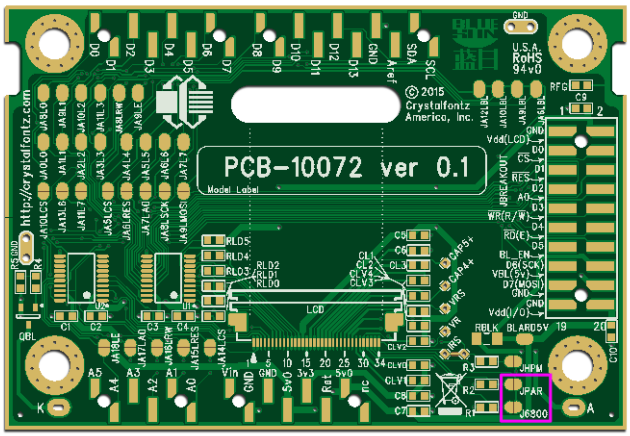
7.2. Interface Control

The board is shipped with both interface control jumpers open. This defaults the interface selection to SPI.

The JPAR jumper selects to parallel when closed, with a default of 8080. JPAR connects to the LCD pin 32, P/S.

The J6800 jumper changes the interface to 6800 when JPAR is also closed. J6800 connects to the LCD pin 31 C86.

For more detail about the connections of various jumpers, see the CFA-10072 schematic.



8. Interface Pin Function – JBREAKOUT (20-pin header)

This header is not included, but can be added to the existing pads. The pads are designed for a surface mount 20-position dual side 0.1" header such as the Samtec TSM-110-01-L-DV-A.

Pin No.	Symbol	Function
1	GND	Ground
2	VDD	3.3v
3	D0	D0 of data bus
4	CS	Chip select
5	D1	D1 of data bus
6	RES	Reset
7	D2	D2 of data bus
8	A0	Data/Command (register select) 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 command data.
9	D3	D3 of data bus
10	WR(R/W)	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
11	D4	D4 of data bus
12	RD(E)	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.
13	D5	D5 of data bus
14	LCD_BL	Backlight control circuit input pin
15	D6 (SCK)	D6 of data bus. Serves as clock for SPI interface
16	BL_5V_IN	Backlight power supply
17	D7 (MOSI)	D7 of data bus. Serves as MOSI for SPI interface
18	GND	Ground
19	GND	Ground
20	VDD	5V

9. Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Notes
Power Supply Voltage	V_{DD}	-0.3	5.0	V	(1)(2)
Input Voltage	V_I	-0.3	V_{DD}+0.3	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 absolute maximum ratings may affect device reliability or cause permanent damage. Functional operation should be restricted to the limits in the Electrical Characteristics table below.

10. Electrical Characteristics

This board is designed to work as a shield for a 5v Arduino Uno. If using JBREAKOUT instead, the board can be used at different voltage levels as described in the Texas Instruments TXB0108 8-Bit Bidirectional Voltage-Level Translator with Auto-Direction Sensing and ±15-kV ESD Protection datasheet.

11. Optical Characteristics

11.1. CFAG12864Q1-TMI

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	-	-	200	300	ms
	T fall	-	-	250	350	ms

11.2. CFAG12864Q1-TFH

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ	CR≥2	0	-	30	ϕ = 180°
	θ	CR≥2	0	-	60	ϕ = 0°
	θ	CR≥2	0	-	45	ϕ = 90°
	θ	CR≥2	0	-	45	ϕ = 270°
Contrast Ratio	CR	-	-	5	-	-
Response Time	T rise	-	-	200	300	ms
	T fall	-	-	250	350	ms

12. Backlight Information

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Notes
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).

13. 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.

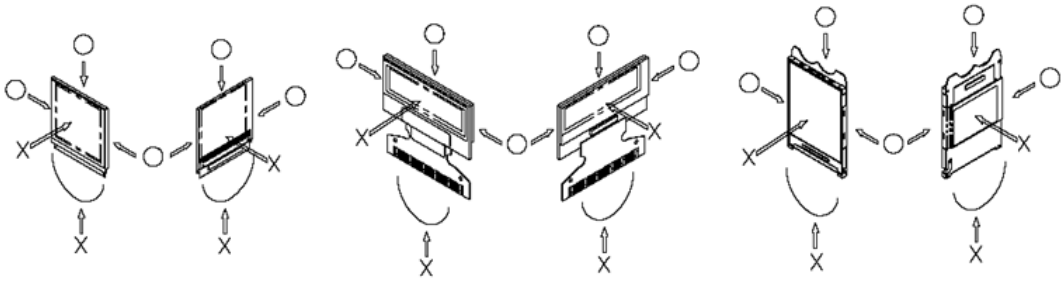
13.1. Modules

- 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.).

13.2. 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 accidently 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.

13.3. 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.

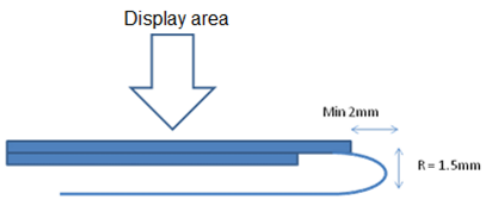
13.4. Designing Precautions

- 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.

13.5. 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.

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 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: