FULL COLOR TFT LCD MODULE SPECIFICATIONS

Datasheet Release 2017-04-04
for
CFAF800480C1-050T

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

Table of Contents

Table of Figures

1. General Information

Datasheet Revision History
Datasheet Version: **2017-04-04** This datasheet is for the CFAF800480C1-050T Full Color TFT LCD module. For information about firmware and hardware revisions, see the Part Change Notifications (PCNs) under "News" in our website's navigation bar. To see the most recent PCN for the CFA633 family at the time of this datasheet release, see PCN #10402. Previous datasheet Version: **2016-09-13** For reference, previous datasheets may be downloaded by clicking the "Show Previous Versions of Datasheet" link under the "Datasheets and Files" tab of the product web page.

Product Change Notifications
To check for or subscribe to "Part Change Notices" for this display module, see the Product Notices tab on the product's webpage.

Variations
Slight variations (for example, contrast, color, or intensity) between lots are normal.

Volatility
This display module has volatile memory.

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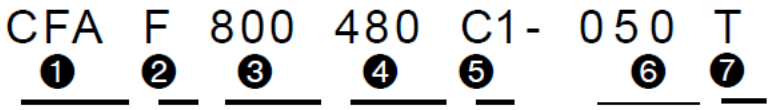
2. Introduction

This display is a color active matrix Thin Film Transistor (TFT), Liquid Crystal Display (LCD), that uses amorphous silicon TFT as a switching device. This module is composed of a TFT LCD panel, a driving circuit and a back-light system with a 5.0 (15:9) inch diagonally measured active display area.

2.1. Main Features

- Full-color (262K) 800xRGBx480 display module consists of a TFT panel, a driver IC, an FFC/FPC flexible cable, and an LED backlight. Please note that this display module does not include an onboard LCD controller.
- This module requires a 5v supply.
- Host interface is DOT-CLK interface / Generic RGB.
- 12:00 o'clock viewing angle (polarizer viewing direction), that can be rotated for portrait or landscape orientation.
- Operating temperature range is from -20°C to +70°C.
- Crystalfontz America, Inc. is ISO 9001:2008 certified.
- A Declaration for Conformity, RoHS, and REACH:SVHC are available under the “Datasheets & Files” tab on the web page for each display.

2.2. Module Classification Information



1	**Brand**	Crystalfontz America, Incorporated
2	**Model Identifier**	F - TFT
3	**Number of Pixels (width)**	800 pixels
4	**Number of Pixels (height)**	480 pixels
5	**Module Identifier**	C1
6	**Diagonal Size**	5.0 inch
7	**Backlight Type and Color**	T White LED Backlight

3. Mechanical Characteristics

3.1. Physical Characteristics

Item	Specification (mm)	Specification (inch, reference)
Module Overall Dimensions		
Width and Height	121 (W) x 76 (H)	4.66 (W) x 3.05 (H)
Viewing Area	110.3 (W) x 68.5 (H)	4.37 (W) x 3.46 (H)
Active Area	108 (W) x 64.8 (H)	1.67 (W) x 2.55 (H)
Character Size	2.95 (W) x 5.55 (H)	0.116 (W) x 0.219 (H)
Dot Size	0.135 (W) x 0.135 (H)	3.43 (W) x 3.43 (H)

3.2. Mechanical Information

Item		Minimum	Typical	Maximum	Unit
Module Size	Horizontal	121	121	121.3	mm
	Vertical	75.85	76	76.25	mm
	Depth	-	3.4	3.7	mm
Weight (without inverter)		-	66	-	g

4. Electrical Characteristics

4.1. Operating Values

Item	Symbol	Minimum	Typical	Maximum	Unit	Note
Supply Voltage	V_{DD}	3.0v	3.3v	3.6v	V	-
Absolute Supply Voltage	V_{DD}	-0.5v	-	5.0v	V	GND=0
Input Signal Voltage	V_{iH}	0.7 V_{DD}	-	V_{DD}	V	(1)
	V_{IL}	GND	-	0.3 V_{DD}	V	(2)
Absolute Signal Voltage	V_i	-0.3v	-	V_{DD} +0.3v	V	-
Current of Power Supply	I_{DD}	-	-	220	mA	VDD =3.3v

Notes:
(1) HSYNC, VSYNC, DE, R/G/B Data
(2) GND = 0V

4.2. Backlight Unit

Item	Symbol	Typical	Maximum	Unit	Note
Forward Current	I_L	40	40	mA	(1)(2)(3)
Forward Voltage	V_L	23.1*	-	V	(1)(2)(3)
Operating LED Lifetime	Hr	10000	-	-	(1)(2)(3)(4)

Notes:
(1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.
(2) Ta = 25±2°C
(3) Test Condition: LED current 40mA. The LED lifetime could be decreased if operating IL is larger than 40mA.
(4) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=40mA. The LED lifetime could be decreased if operating IL is larger than 40mA. The constant current driving method is suggested.

*** CAUTION**

Do not drive the LEDs at any current over their rated maximum. Be aware that the forward voltage of white LEDs can vary (LED to LED, batch to batch, and over time) by a significant amount. We recommend using a constant current LED power supply such as the AP3036, NCP5007, FAN5333, or similar to drive the LEDs. Do not use a constant voltage source to drive the LEDs.

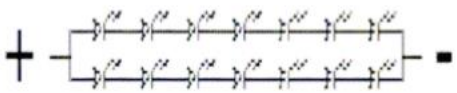


Figure 1. LED Light Bar Circuit

4.3. AC Characteristics

Item	Symbol	Minimum	Typical	Maximum	Unit
DCLK Cycle Time	Tclk	25			ns
DCLK Frequency	fclk		33	40	MHz
DCLK Pulse Duty	Tcwh	40	50	60	%
VSYNC Setup Time	Tvst	8			ns
VSYNC Hold Time	Tvhd	8			ns
HSYNC Setup Time	Thst	8			ns
HSYNC Hold Time	Thhd	8			ns
Data Setup Time	Tdasu	8			ns
Data Hold Time	Tdahd	8			ns
DE Setup Time	Tdesu	8			ns
DE Hold Time	Tdehd	8			ns
Horizontal Display Area	Thd		800		Tcph
HSYNC Period Time	Th		928		Tcph
HSYNC Width	Thwh	1	48		Tcph
HSYNC Back Porch	Thbp		40		Tcph
HSYNC Front Porch	Thfp		40		Tcph
Vertical Display Area	Tvd		480		th
VSYNC Period Time	Tv		525		th
VSYNC Width	Tvwh		3		th
VSYNC Back Porch	Tvbp		29		th
VSYNC Front Porch	Tvfp		13		th

4.4. Interface Signal Timing Diagram

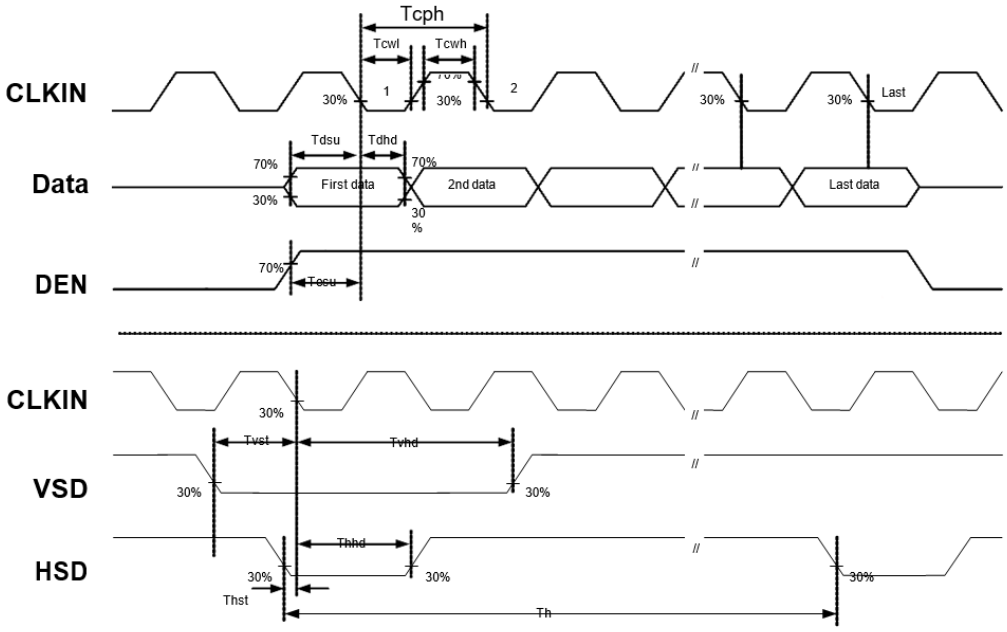


Figure 2. Clock Timing Sample

4.5. Time Range

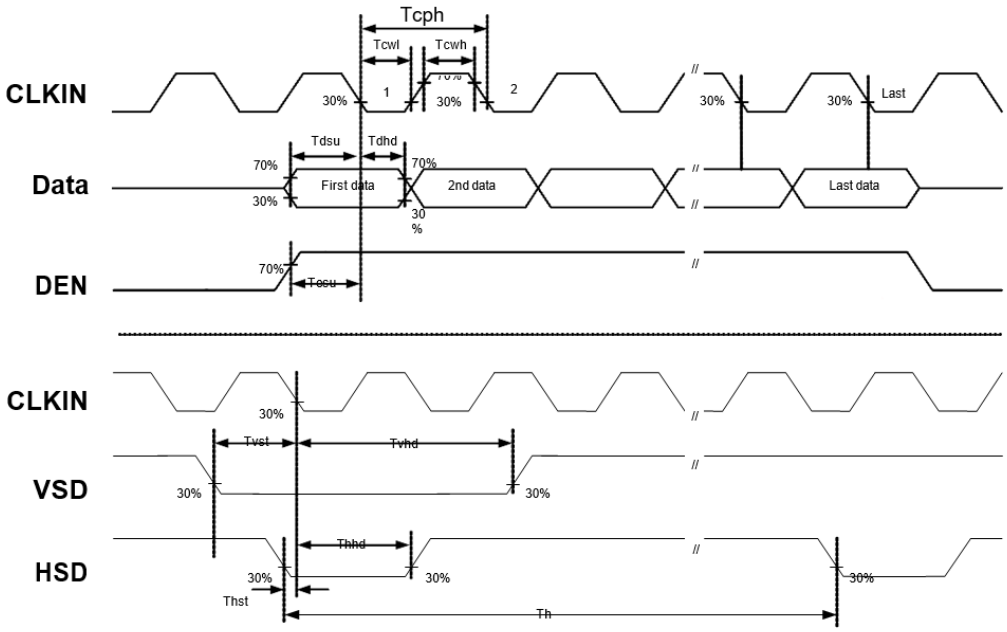


Figure 3. Horizontal Display

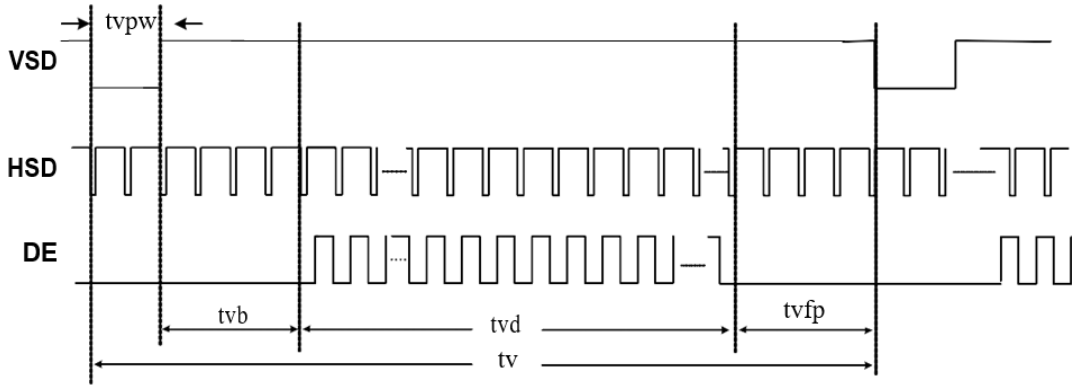
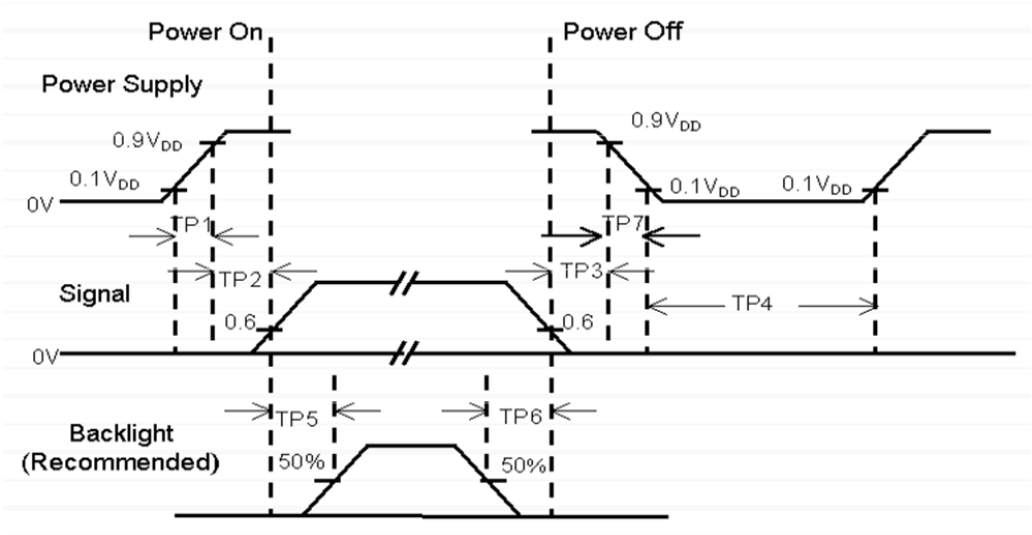


Figure 4. Vertical Display

4.6. Power Sequence



Item	Minimum	Typical	Maximum	Unit
TP1	0.5	--	10	msec
TP2	0	--	50	msec
TP3	0	--	50	msec
TP4	1000	--	--	msec
TP5	200	--	--	msec
TP6	200	--	--	msec
TP7	0.5	--	10	msec

Notes:

(1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD}.

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

(3) In case of V_{DD} = off level, please keep the level of input signal on the low or keep a high impedance.

(4) TP4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

5. Environment Absolute Ratings

Item	Symbol	Minimum	Maximum	Unit	Note
Operating Temperature	T_{OPA}	-20	70	°C	-
Storage Temperature	T_{STG}	-30	80	°C	-

6. Optical Characteristics

6.1. Optical Specifications

Item		Symbol	Condition	Minimum	Typical	Maximum	Unit
Contrast		CR	θ=0 Normal Viewing Angle	480	-	-	
Response Time	Rising	T_R		-	2	4	msec
	Falling	T_F		-	6	12	
White Luminance (Center)		Y_L		320	400	-	cd/m^2
Color Chromaticity (CIE1931)	White	W_X		0.260	0.310	0.360	
		W_Y		0.280	0.330	0.380	
Viewing Angle	Horizontal	θ_L	CR>10	65	75	-	
		θ_R		65	75	-	
	Vertical	θ_U		50	60	-	
		θ_D		60	70	-	
Brightness Uniformity		B_{UNI}	θ=0	70	-	-	%
Optima View Direction			12 o'clock				

6.2. Measuring Condition

- Measuring surrounding: dark room
- LED current I_L: 40mA
- Ambient Temperature: 25±2°C
- 15-minute warm-up time

6.3. Measuring Equipment

- FPM520 of Westar Display Technologies, Inc. that utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.
- Measuring Spot Size: 20~21m

6.4. Definition of Viewing Angles

This module has a **12:00 o'clock** viewing angle.

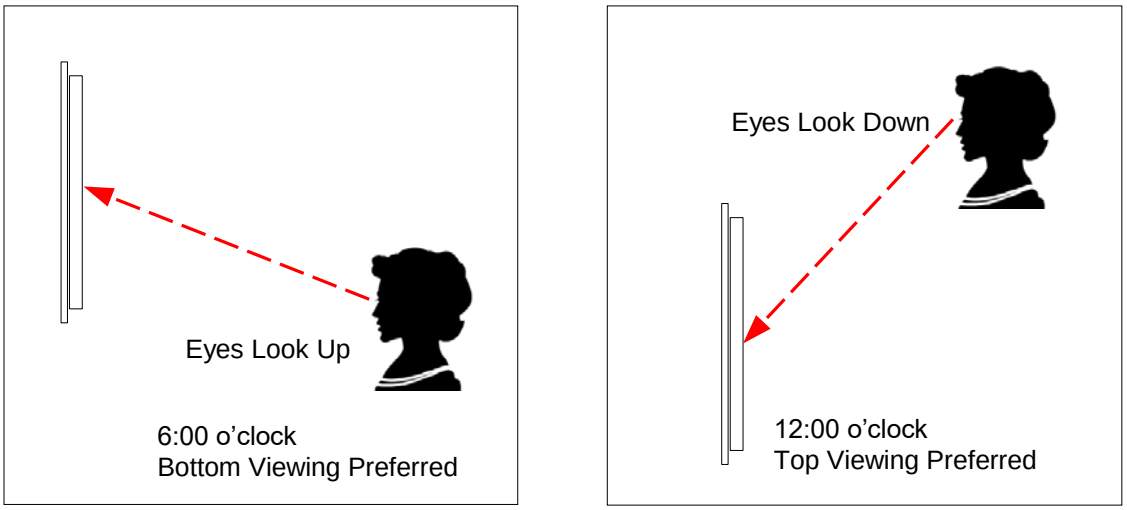


Figure 5. Definition of 6:00 o'clock and 12:00 o'clock Viewing Angles

6.5. Definition of Response Time (Tr, Tf)

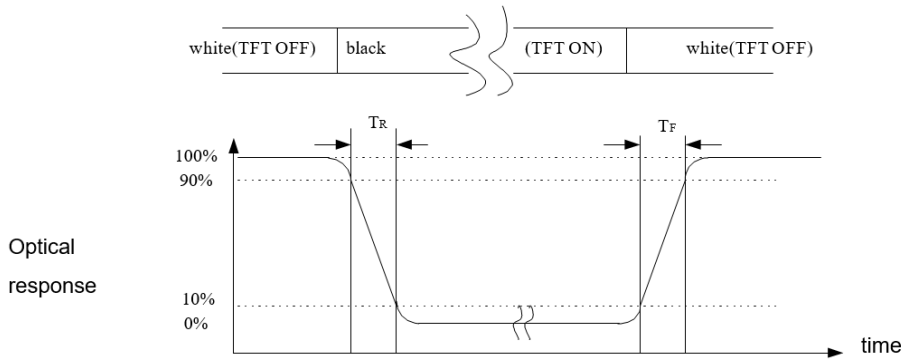


Figure 6. Definition of Response Time (Tr, Tf)

6.6. Definition of Optical Measurement Set-up

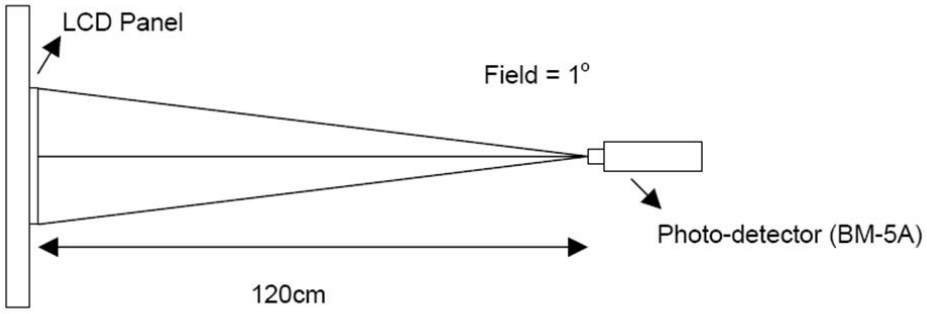
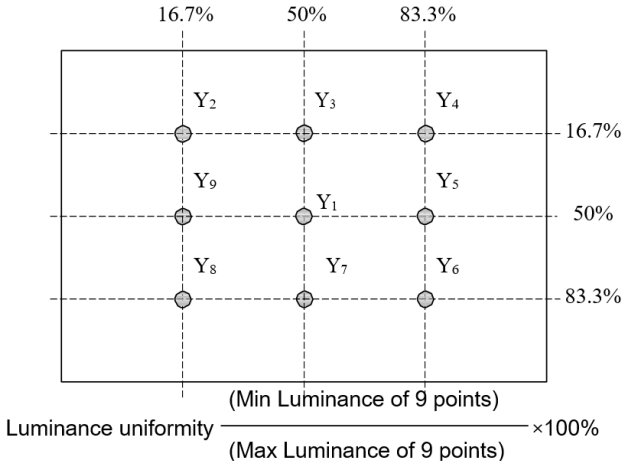


Figure 7. Definition of Optical Measurement Set-up

6.7. Definition of Brightness Uniformity



Notes:

(1) Rubbing Direction (different rubbing direction will cause different optima view direction.

(2) Measured at the brightness of the panel when all terminals of LCD panel are electronically open.

Figure 8. Definition of Brightness Uniformity

7. System Block Diagram

7.1. TFT LCD Module

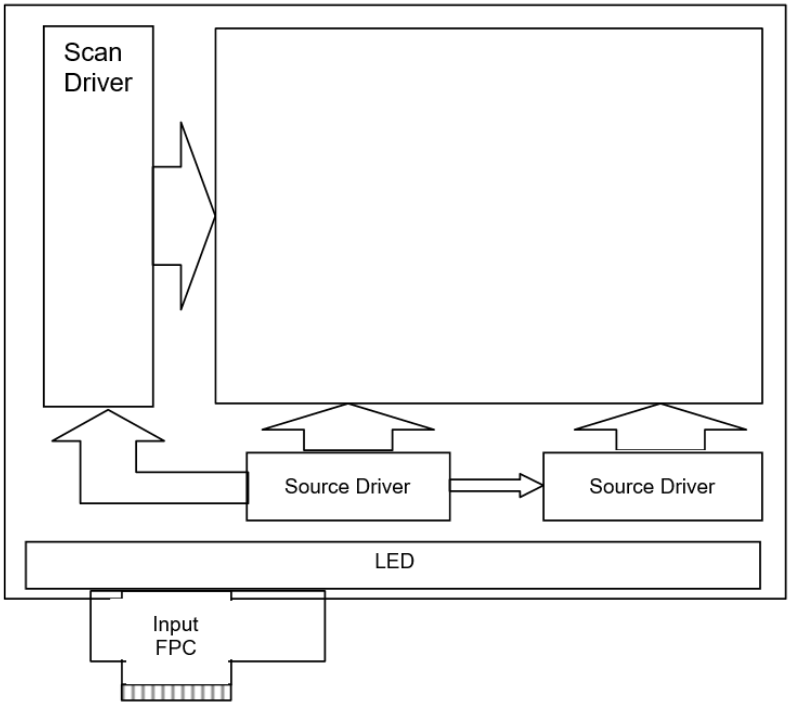


Figure 9. TFT LCD Module

7.2. Pixel Format Diagram

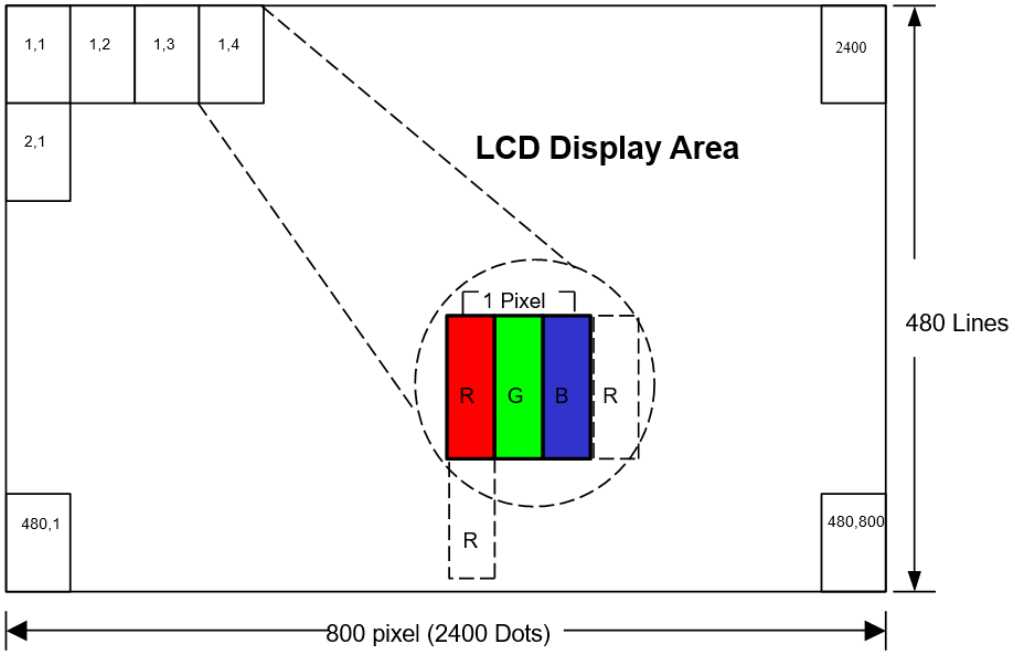


Figure 10: Pixel Format Diagram

7.3. Interface PIN Function

PIN No.	Symbol	I/O	Function
1	V_{LED-}	P	Power for LED Backlight Cathode
2	V_{LED+}	P	Power for LED Backlight Anode
3	GND	P	Power Ground
4	V_{DD}	P	Power Voltage
5	R0	I	Red Data (LSB)
6	R1	I	Red Data
7	R2	I	Red Data
8	R3	I	Red Data
9	R4	I	Red Data
10	R5	I	Red Data
11	R6	I	Red Data
12	R7	I	Red Data (MSB)
13	G0	I	Green Data (LSB)
14	G1	I	Green Data
15	G2	I	Green Data
16	G3	I	Green Data
17	G4	I	Green Data
18	G5	I	Green Data
19	G6	I	Green Data
20	G7	I	Green Data (MSB)
21	B0	I	Blue Data (LSB)
22	B1	I	Blue Data
23	B2	I	Blue Data
24	B3	I	Blue Data
25	B4	I	Blue Data
26	B5	I	Blue Data
27	B6	I	Blue Data
28	B7	I	Blue Data (MSB)
29	DGND	I	Digital Ground
30	DCLK	I	Pixel Clock
31	DISP	I	Display On/ Off
32	HSYNC	I	Horizontal Sync Signal
33	VSYNC	I	Vertical Sync Signal
34	DE	I	Data Enable
35	NC	-	No Connect
36	GND	P	Power Ground
37	X_R	I/O	Right Electrode - Differential Analog
38	Y_B	I/O	Bottom Electrode - Differential Analog
39	X_L	I/O	Left Electrode - Differential Analog
40	Y_T	I/O	Top Electrode - Differential Analog
I/O: I = Input / O = Output. P = Power			

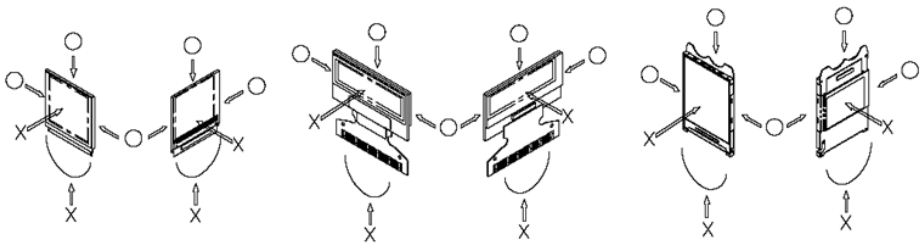
8. Precautions in Use of LCD Modules

8.1. 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 R2and R3 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.).

8.2. 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.

8.3. 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.

8.4. 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)
- 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.

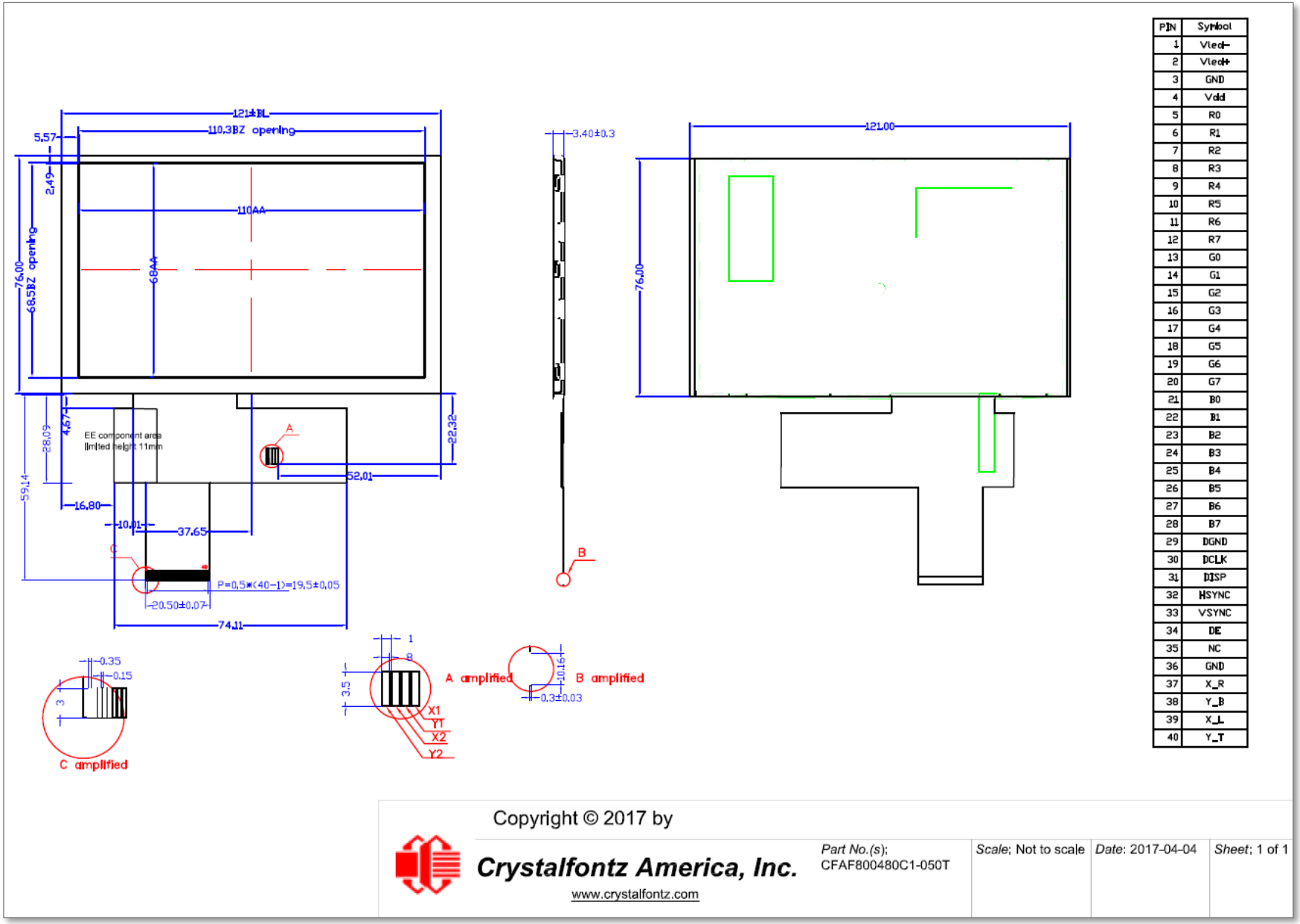
8.5. Precautions When Disposing of the LCD Display Modules

- 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.

8.6. 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.

9. Mechanical Drawing



PIN	Symbol
1	Vled-
2	Vled+
3	GND
4	Vdd
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	B0
22	B1
23	B2
24	B3
25	B4
26	B5
27	B6
28	B7
29	DGND
30	DCLK
31	DISP
32	HSYNC
33	VSYNC
34	DE
35	NC
36	GND
37	X_R
38	Y_B
39	X_L
40	Y_T

Crystalfontz America, Inc.
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Part No.(s):	Scale: Not to scale	Date: 2017-04-04	Sheet: 1 of 1
CFAF800480C1-050T			