GRAPHIC LCD MODULE DATASHEET

Datasheet Release Date 2017-11-29
for
CFAX12864T-TFH

Crystalfontz America, Inc.

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1. General Information

Datasheet Revision History
Datasheet Release: **2017-11-29** Datasheet for the CFAX12864T-TFH 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

This is a light weight, thin, low-power light gray graphic LCD display module with a white LED backlight. This display is perfectly suited for hand-held displays and other applications that require a thin display with low-power consumption. This display has a built-in Novatek NT7534 controller.

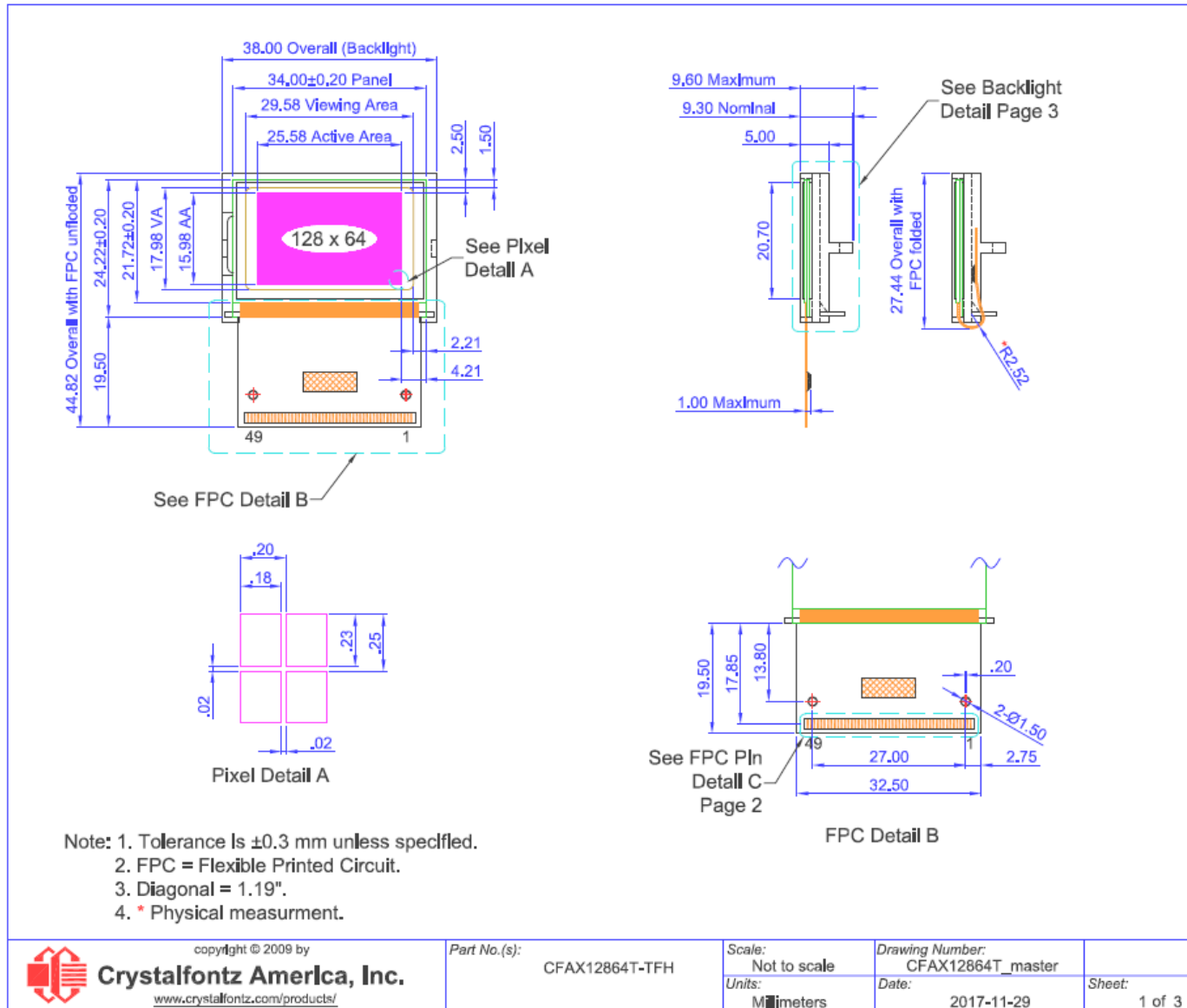Please see Novatek NT7534 LCD Controller Datasheet for further reference.
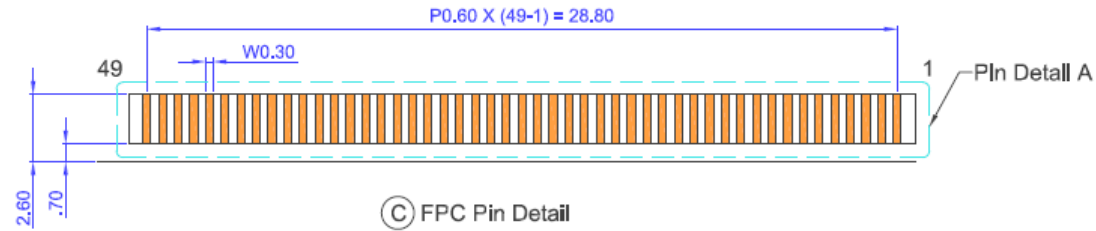
3. Features

- 128*64 Dot Matrix
- Built-in Controller: NT7534 (or equivalent)
- Viewing Direction: 6 o'clock
- FSTN Positive, Transflective Mode
- Operating Temperature: -20°C to +70°C
- Storage Temperature: -30°C to +80°C
- +3V Power Supply
- White LED Backlight
- 1/64 Duty
- Interface: 8-Bit Parallel / SPI

4. Mechanical Data

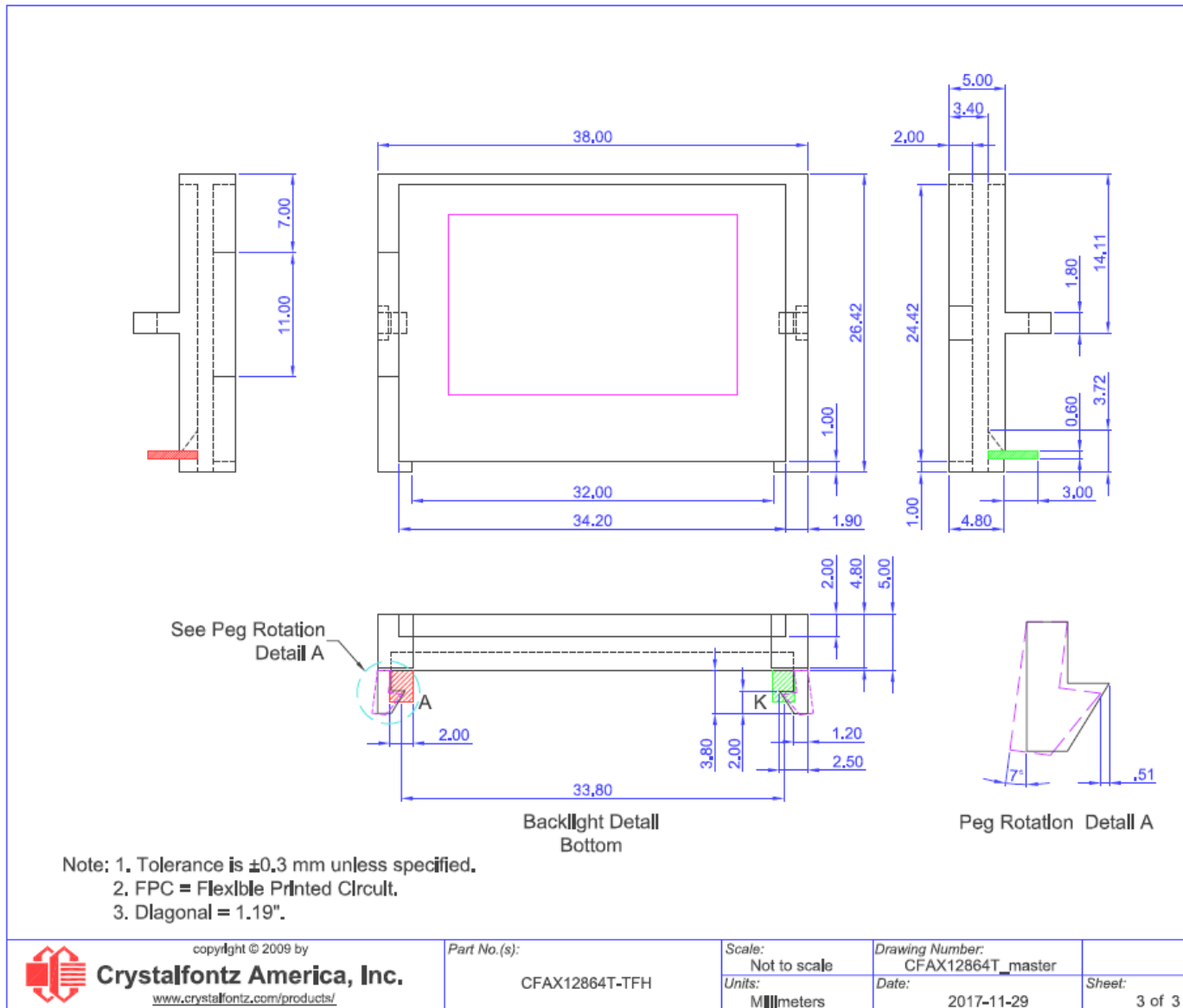| Item	Specification (mm)	Specification (inch, reference)
Overall Width and Height	38.0 (W) x 27.44 (H) x 9.6 (D)	1.496 (W) x 1.080(H) x 0.378 (D)
Viewing Area	29.58 (W) x 17.98 (H)	1.165 (W) x 0.708 (H)
Active Area	25.58 (W) x 15.98 (H)	1.007 (W) x 0.629 (H)
Dot Size	0.18 (W) x 0.23 (H)	0.007 (W) x 0.009 (H)
Dot Pitch	0.20 (W) x 0.25 (H)	0.008 (W) x 0.010 (H)
Weight (Typical)	5 grams	0.18 ounces

5. Mechanical Drawings

38.00 Overall (Backlight)
34.00±0.20 Panel
29.58 Viewing Area
25.58 Active Area
2.50
1.50

128 x 64

See Pixel Detail A

44.82 Overall with FPC unfolded
24.22±0.20
21.72±0.20
17.98 VA
15.98 AA
19.50
2.21
4.21
49   1

See FPC Detail B

9.60 Maximum
9.30 Nominal
5.00
20.70

See Backlight Detail Page 3

27.44 Overall with FPC folded

1.00 Maximum
*R2.52

.20
.18
.23
.25
.02
.02

Pixel Detail A

19.50
17.85
13.80
.20
2-Ø1.50
49   1
27.00
2.75
32.50

See FPC Pin Detail C Page 2

FPC Detail B

Note: 1. Tolerance is ±0.3 mm unless specified.
2. FPC = Flexible Printed Circuit.
3. Diagonal = 1.19".
4. * Physical measurment.

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Part No.(s): CFAX12864T-TFH	Scale: Not to scale	Drawing Number: CFAX12864T_master	
	Units: Millimeters	Date: 2017-11-29	Sheet: 1 of 3

P0.60 X (49-1) = 28.80

W0.30

49

1 — Pin Detail A

2.60 .70

© FPC Pin Detail

49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
NC	NC	NC	NC	FR	CL	$\overline{DOF}$	NC	$\overline{CS1}$	CS2	$\overline{RST}$	D/C	$\overline{WR}_{8080}$ (R/$\overline{W}_{6800}$)	$\overline{RD}_{8080}$ (E_{6800})	D0	D1	D2	D3	D4	D5	D6	D7	DUTY0	DUTY1	V_{DD}	V_{DD2}	GND	V_{OUT}	NC	C3+	C1-	C1+	C2+	C2-	NC	NC	V1	V2	V3	V4	V0	VR	$\overline{MS}$	CLS	C86	PS	HPM	IRS	NC

Pin Detail A

Note: 1. Tolerance is ±0.3 mm unless specified.
      2. FPC = Flexible Printed Circuit.
      3. Diagonal = 1.19".

| Part No.(s): CFAX12864T-TFH | Scale: Not to scale | Drawing Number: CFAX12864T_master | |
| | Units: Millimeters | Date: 2017-11-29 | Sheet: 2 of 3 |

See Peg Rotation
Detail A

A

K

Backlight Detail
Bottom

7°

.51

Peg Rotation Detail A

Note: 1. Tolerance is ±0.3 mm unless specified.
2. FPC = Flexible Printed Circuit.
3. Diagonal = 1.19".

copyright © 2009 by	Part No.(s):	Scale: Not to scale	Drawing Number: CFAX12864T_master	
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6. Interface Pin Function

Pin No.	Symbol	I/O	Function
1	NC	-	No Connection
2	IRS	I	This terminal selects the resistors for the V0 voltage level adjustment IRS = "H", Use the internal resistors IRS = "L", Do not use the internal resistors The V0 voltage level is regulated by an external resistive voltage divider attached to the VR terminal. This pad is enabled only when the master operation mode is selected. It is fixed to either "H" or "L" when the slave operation mode is selected
3	/HPM	I	This is the power control terminal for the power supply circuit for liquid crystal drive. /HPM = "H", Normal power mode /HPM = "L", High power mode This pad is enabled only when the master operation mode is selected and it is fixed to either "H" or "L" when the slave operation mode is selected.
4	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><tr><td>P/S</td><td>Data/Command</td><td>Data</td><td>Read/Write</td><td>Serial Clock</td></tr><tr><td>H</td><td>A0</td><td>D0-D7</td><td>/RD. /WR</td><td>-</td></tr><tr><td>L</td><td>A0</td><td>SI (D7)</td><td>Write Only</td><td>SCL (D6)</td></tr></table> When P/S = "L", fix D0~D5 pads to VDD or VSS level. /RD(E) and /WR (R/W) are fixed to either "H" or "L". With serial data input ,RAM display data reading is not supported.
5	C86	I	This is the MPU interface switch terminal C86 = "H":6800 Series MPU interface C86 = "L":8080 Series MPU interface
6	CLS	I	Terminal to select whether enable or disable the display clock internal oscillator circuit. CLS = "H": Internal oscillator circuit for display is enabled. CLS = "L": Internal oscillator circuit for display is not enabled (requires external input). When CLS = "L", input the display clock through the CL pad.
7	M/S	I	This terminal selects the master/slave operation for the NT7534 chips. Master operation outputs the timing signals that required for LCD display, while slave operation inputs the timing signals required for the liquid crystal display, synchronizing the liquid crystal display system.
8	VR	I	Voltage adjustment pad. Applies voltage between V0 and VSS using a resistive divider.
9-13	V0 V4 V3 V2 V1	I/O	LCD driver supplies voltages. The voltage determined by the LCD cell is impedance-converted by a resistive driver or an operation amplifier for application. Voltages should be according to the following relationship: V0≥V1≥V2≥V3≥V4≥VSS2 When the on-chip operating power circuit is on, the following voltages are supplied to V1 to V4 by the on-chip power circuit. Voltages selection is performed by the LCD Bias Set command.
14-15	NC	-	No Connection
16	C2-	O	Capacitor 2-pad for internal DC/DC voltage converter
17	C2+	O	Capacitor 2+pad for internal DC/DC voltage converter

Pin No.	Symbol	I/O	Function
18	C1+	-	Capacitor 1+pad for internal DC/DC voltage converter.
19	C1-	-	Capacitor 1-pad for internal DC/DC voltage converter.
20	C3+	-	Capacitor 3+pad for internal DC/DC voltage converter
21	NC	-	No Connection
22	V_{OUT}	I/O	DC/DC voltage converter output
23	V_{SS}	O	Ground output for pad option.
24	V_{DD2}	Supply	There are the power supply pads for the step-up voltage circuit for the LCD. These pads must be connected to each other.
25	V_{DD}	O	Power supply output for pad option.
26	DUTY1	I	Select the maximum LCD driver duty.
27	DUTY0		
28-35	D7-D0	I/O	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected (P/S= "L"), then D7 serves as the serial data input terminal (SI) and D6 serves as the serial clock input terminal (SCL). When the serial interface is selected, fix D0~D5 pads to VDD or VSS level. When the chip select is inactive, D0 to D7 are set to high impedance.
36	/RD	I	When connected to an 8080 MPU, it is active LOW. This pad is connected to the /RD signal of the 8080 MPU, and the NT7534 data bus is in an output status when this signal is "L". When connected to a 6800 Series MPU, this is active HIGH. This is used as an enable clock input of the 6800 series MPU
37	/WR	I	When connected to an 8080 MPU, this is active LOW. This terminal connects to the 8080 MPU, and the NT7534 data bus are latched at rising edge of the /WR signal. When connected to an 8080 MPU, this is the read/write control signal input terminal. When R/W= "H": Read When R/W= "L": Write
38	A0	I	his is connected to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or a command. A0= "H": Indicate that D0 to D7 are display data A0= "L": Indicate that D0 to D7 are control data
39	/RES	I	When /RES is set to "L" the settings are initialized. The reset operation is performed by the /RES signal level.
40	CS2	I	This is the chip select signal.
41	/CS1	-	This is the chip select signal.
42	NC	-	No Connection

Pin No.	Symbol	I/O	Function
43	/DOF	I/O	This is the liquid crystal display blanking control terminal. M/S= "H": output M/S= "L": Input When the NT7534chip is used in master/slave mode, the various DOF terminals must be connected.
44	CL	-	This is the display clock input terminal. When the NR7534 chips are used in master/slave mode, the carious CL terminals must be connected.
45	FR	I/O	This is the liquid crystal alternating current signal I/O terminal M/S= "H": output M/S= "L": input When the NT7534chip is used in master/slave mode, the various FR terminals must be connected.
46-49	NC	-	No Connection

7. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for Logic	V_{DD} -V_{SS}	-0.3	4.0	V	(1)(2)
Supply Voltage for LCD	V_{OUT}	-0.3	15.0	V	(1)(2)
Input Voltage	V_{IN}	-0.3	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.

8. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	V_{DD} -V_{SS}	-	3.0	3.3	3.6	V
Supply Voltage for LCD	V_O -V_{SS}	Ta=-20°C	-	-	-	V
		Ta=25°C	-	9.0	-	V
		Ta=70°C	-	-	-	V
High-level Input	V_{IH}	-	$0.8V_{DD}$	-	V_{DD}	V
Low-level Input	V_{IL}	-	V_{SS}	-	$0.2V_{DD}$	V
High-level Output	V_{OH}	-	$0.8V_{DD}$	-	V_{DD}	V
Low-level Output	V_{OL}	-	V_{DD}	-	$0.2V_{DD}$	V
Supply Current	I_{DD}	V_{DD} = 3.3V	-	0.25	1.0	mA

9. Optical Characteristics

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

10. Backlight Information

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Notes
Forward Current	I_{LED}	V=3.5v	-	32	40	mA	(1)
Forward Voltage	V	-	3.4	3.5	3.6	V	-
Reverse Voltage	V_R	-	-	-	5	V	-
Color Coordinate	X	I_{LED}=32mA	0.26	0..28	0.30	-	-
	Y		0.28	0.30	0.32		
Luminance (without LCD)	I_V	I_{LED}=32mA	880	1100	-	cd/m^2	-
LED Lifetime	-	I_{LED}=32mA 25°C, 50-60% RH	-	50K	-	Hr.	(2)
Color	White						

Notes:
(1) Forward 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).

11. 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.

11.1. 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.
  o Do not use the fixed information for long periods of time in real application.
  o 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.).

11.2. 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.
  o Scotch Mending Tape No. 810 or an equivalent
  o 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.
  o 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.
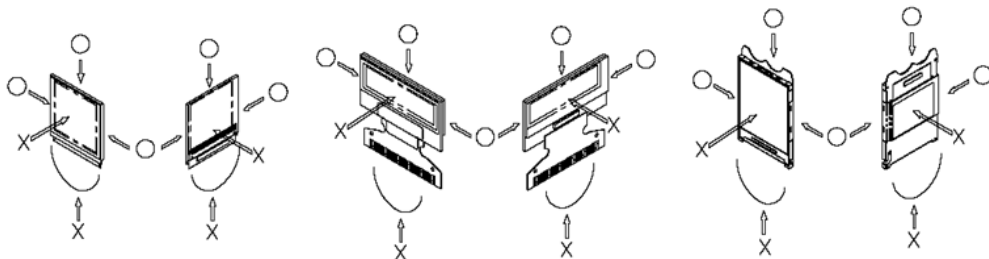
- Do not apply stress to the LSI chips and the surrounding molded sections.
- Do not disassemble or modify the LCD display module.
- Do not apply input signals while the logic power is off.
- Pay sufficient attention to the working environments when handing the LCD display module to prevent occurrence 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.

11.3. 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.

11.4. 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.

11.5. 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.

11.6. 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: