



TFT DISPLAY MODULE DATASHEET



Datasheet Release Date 2017-07-31
for
CFAF320480C5-035T-TS

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1. General Information

Datasheet Revision History

Datasheet Release: **2017-07-31**
Datasheet for the CFAF320480C5-035T-TS TFT graphic 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 3.5-inch diagonal full color TFT graphic display module with a 4-wire analog touch screen and a white LED backlight. This display requires only a single source 3.3v for both power supply and logic. This display has a built-in Himax HX8357-B controller.

Please see [Himax HX8357-B LCD Controller Datasheet](#) for further reference.

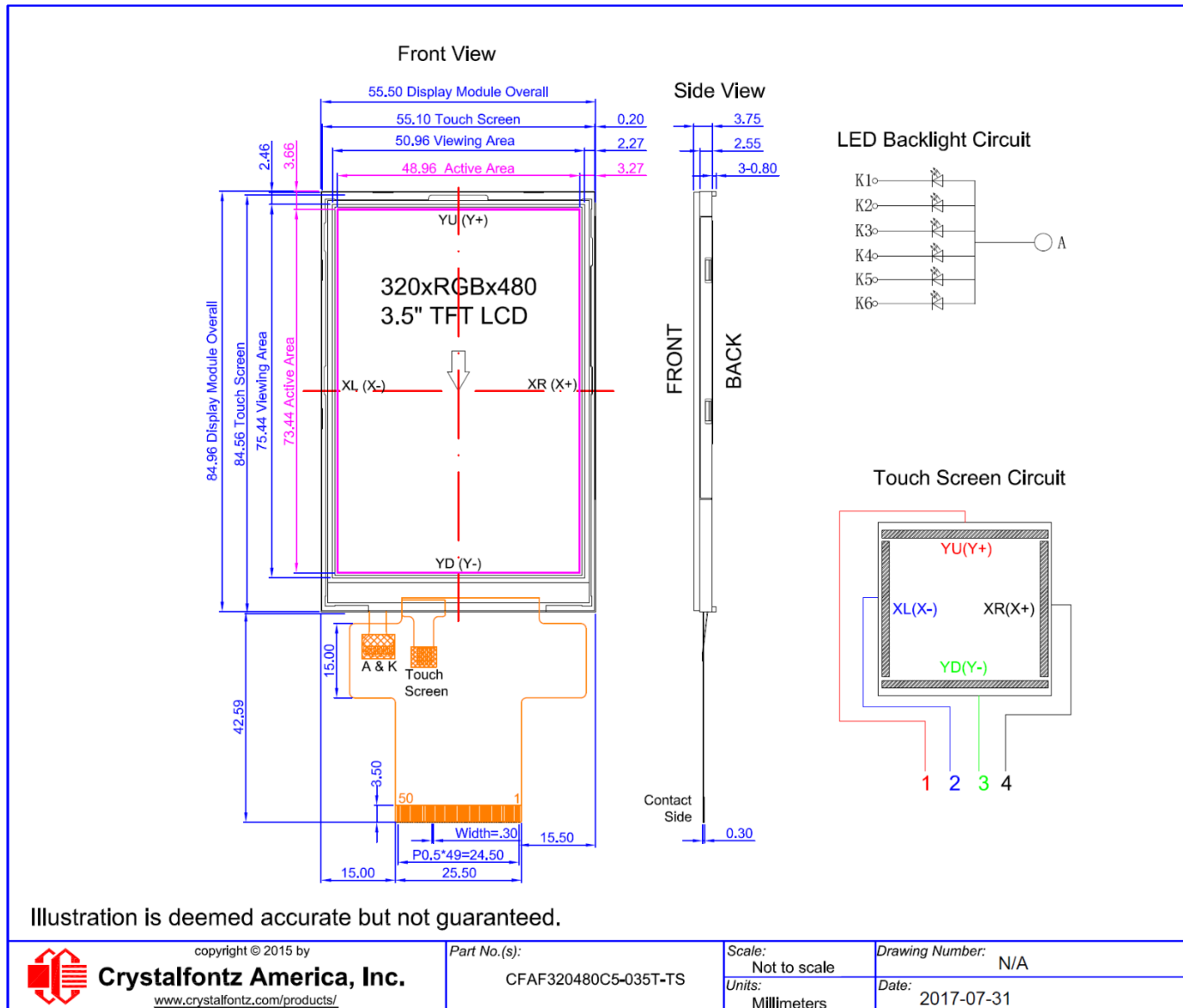
3. Features

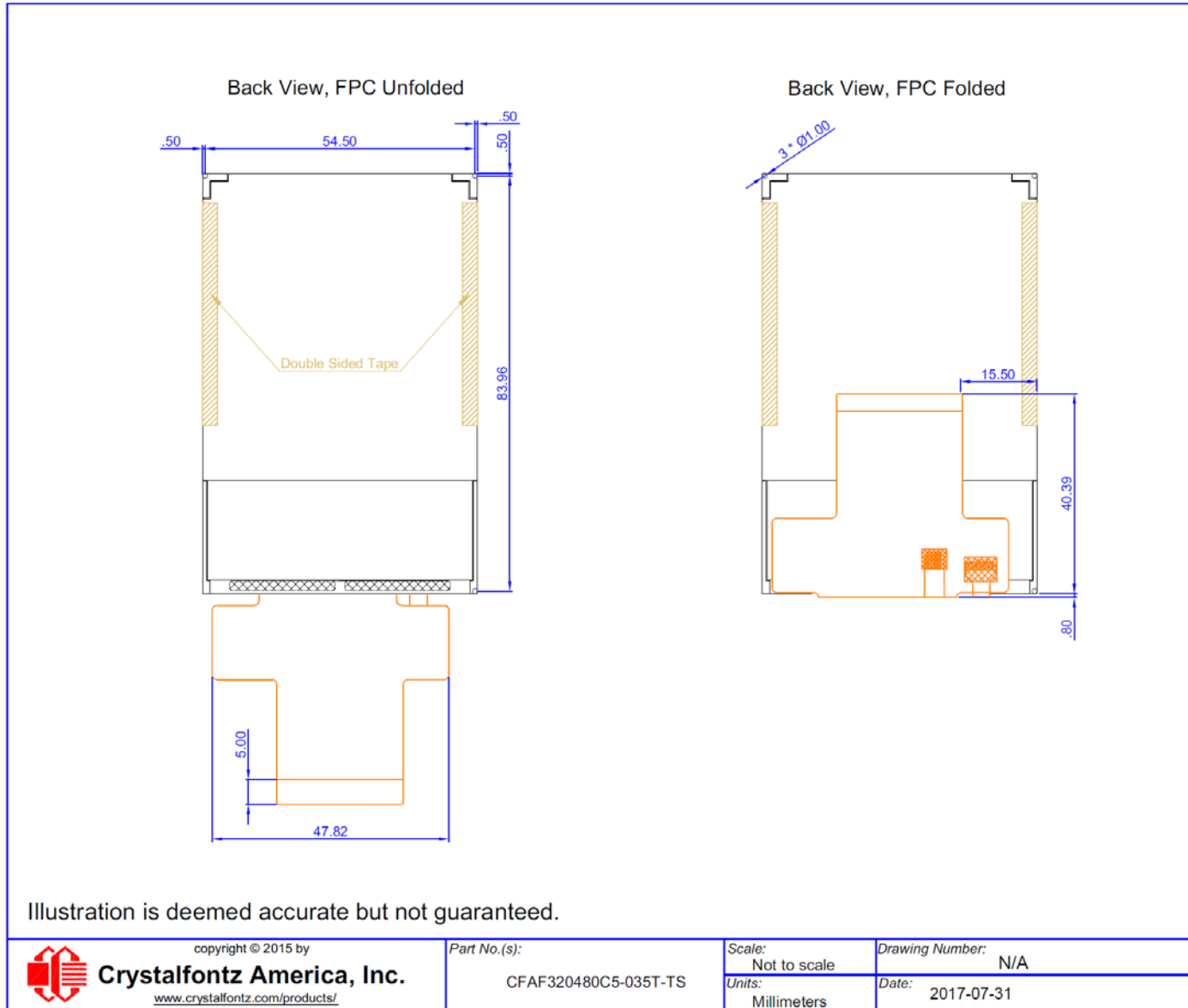
- 320*480 Dot Matrix
- Built-in Controller: HX8357-B (or equivalent)
- +3V Power Supply
- Viewing Direction: 6 o'clock
- 1/16 Duty
- Operating Temperature: -20°C to +70°C
- Interface: 6800, 8080, 3 or 4-Wire SPI, DOTCLK RGB

4. Mechanical Data

| Item | Specification (mm) | Specification (inch, reference) |
|--|-----------------------------------|-----------------------------------|
| Overall Module Dimension with FPC Unfolded | 55.50 (W) x 127.55 (H) x 3.75 (D) | 2.185 (W) x 5.022 (H) x 0.148 (D) |
| Overall Module Dimension with FPC Folded | 55.50 (W) x 84.96 (H) x 3.75 (D) | 2.185 (W) x 3.345 (H) x 0.148 (D) |
| Viewing Area | 52.96 (W) x 75.44 (H) | 2.085 (W) x 2.970 (H) |
| Active Area | 48.96 (W) x 73.44 (H) | 1.928 (W) x 2.891 (H) |
| Pixel Pitch | 0.051 (W) x 0.051 (H) | 0.002 (W) x 0.002 (H) |
| FFC Bend Radius | >R.95 mm | - |
| Weight (Typical) | 28 grams | 0.98 ounces |
| NOTE: The display module's 50-pin FFC mates with standard 0.5mm ZIF connectors such as HFJ150CT-ND and HFK150CT-ND available from Digi-Key. | | |

5. Mechanical Drawings



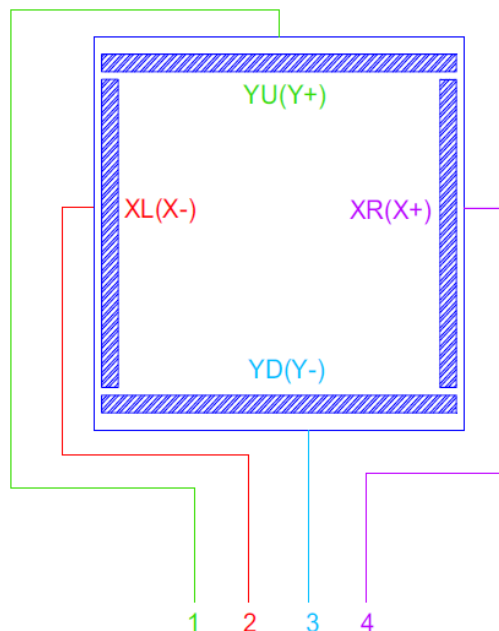


6. Interface Pin Function

| Pin | Symbol | Level | Direction | Function | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|------------------------|-------|-------------------|---|------------------|----------------|-----|----------------|----------------|--|--|--|--|--|---|---|---|------------------|----------|---|---|---|-----------------|---------|---|---|---|------------------|----------|---|---|---|-----------------|---------|-----------------|--|--|--|--|---|---|---|-------------------|--------------|---|---|---|-------------------|------------------|
| 1 | GND | 0v | - | Ground. Must be connected to an external ground. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2-3 | V _{LOGIC I/O} | 3.3v | I | Digital Logic Supply and Input/Output Supply | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4-5 | V _{ANALOG} | +3.3v | I | Ground. Must be connected to an external ground. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | IM0 | - | I | <table border="1"> <thead> <tr> <th>IM2</th> <th>IM1</th> <th>IM0</th> <th>Interface Mode</th> <th>DB Pins in Use</th> </tr> </thead> <tbody> <tr> <td colspan="5">Parallel (also known as DOTCLK or DPI) Interface</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>18-Bit RGB / DPI</td> <td>DB17-BD0</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>9-Bit RGB / DPI</td> <td>DB8-DB0</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>16-Bit RGB / DPI</td> <td>DB15-BD0</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>8-Bit RGB / DPI</td> <td>DB7-BD0</td> </tr> <tr> <td colspan="5">3 or 4-Wire SPI</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>3-Wire, 9-Bit SPI</td> <td>SDI, SCL, CS</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>4-Wire, 8-Bit SPI</td> <td>SDI, SCL, CS, RS</td> </tr> </tbody> </table> <p>NOTE: If pin is not used, tie to GND or make no connection. DPI = Display Pixel Interface</p> | IM2 | IM1 | IM0 | Interface Mode | DB Pins in Use | Parallel (also known as DOTCLK or DPI) Interface | | | | | 0 | 0 | 0 | 18-Bit RGB / DPI | DB17-BD0 | 0 | 0 | 1 | 9-Bit RGB / DPI | DB8-DB0 | 0 | 1 | 0 | 16-Bit RGB / DPI | DB15-BD0 | 0 | 1 | 1 | 8-Bit RGB / DPI | DB7-BD0 | 3 or 4-Wire SPI | | | | | 1 | 0 | 1 | 3-Wire, 9-Bit SPI | SDI, SCL, CS | 1 | 1 | 1 | 4-Wire, 8-Bit SPI | SDI, SCL, CS, RS |
| IM2 | IM1 | | | IM0 | Interface Mode | DB Pins in Use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Parallel (also known as DOTCLK or DPI) Interface | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | | | 0 | 18-Bit RGB / DPI | DB17-BD0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 0 | | | 1 | 9-Bit RGB / DPI | DB8-DB0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 0 | 16-Bit RGB / DPI | DB15-BD0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 1 | 1 | 8-Bit RGB / DPI | DB7-BD0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 or 4-Wire SPI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 | 1 | 3-Wire, 9-Bit SPI | SDI, SCL, CS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 1 | 1 | 4-Wire, 8-Bit SPI | SDI, SCL, CS, RS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | IM1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | IM2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | RST | L | I | Reset Signal Pin. Low: Display controller is reset. The RST pin should be pulsed low shortly after power is applied. High: The RST pin should be brought high (V _{LOGIC I/O}) for normal operation. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | V _{SYNC} | - | I | Vertical and Horizontal Frame Synchronizing Signal used for RGB / DPI Mode. When not used, pin should be pulled high (V _{LOGIC I/O}). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | H _{SYNC} | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | P _{CLK} | H/L | I | Pixel Clock Signal for RGB / DPI Mode. When not used, pin should be pulled low. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | DE | H/L | I/O | Data Enable Signal for RGB / DPI Mode. When not used, pin should be pulled low. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14-31 | DB17-DB0 | H/L | I/O | <p>In MIPI Data Bus Interface Mode, DB7-DB0 are used as follows:</p> <ul style="list-style-type: none"> 18-Bit Bidirectional Data Bus. 8-Bit Bus: use DB7-DB0 9-Bit Bus: use DB8-DB0 16-Bit Bus: use DB15-DB0 18-Bit Bus: use DB17-DB0 <p>In MIPI DPI Interface Mode, DB17-DB0 are treated as 18-Bit Bus. RGB Data Bus:</p> <ul style="list-style-type: none"> 6-Bit Bus: use DB5-DB0 16-Bit Bus: use DB15-DB0 18-Bit Bus: use DB17-DB0 <p>If not used, connect to V_{SSD}.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 32 | GND | 0v | - | Parallel data bus. (Notice the descending order.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 33 | MISO | - | O | SPI Data Signal. (MISO = Master In Slave Out) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34 | MOSI | - | I | SPI Data Signal. (MOSI = Master Out Slave In) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | RD | - | I | DBI Type-B: Serves as a read signal and read data at the low level. If not used, tie to V _{LOGIC I/O} . | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Pin | Symbol | Level | Direction | Function |
|-------|---|-------|-----------|--|
| 36 | WR_SCK | - | I | DBI Type-B: Serves as a write signal and write data at the low level. DBI Type-C: Serves as Serial Clock (SCK). If not used, tie to $V_{\text{LOGIC I/O}}$. |
| 37 | D/C | H/L | - | Data/Command Control. Determines whether data bits are data or command. 1 – High: Addresses the data register. 0- Low: Addresses the command register. If not used, tie to $V_{\text{LOGIC I/O}}$. |
| 38 | CS | H/L | I | Chip Select Input Pin. Low: Controller Chip is Selected. Communication with host is possible. High: Controller Chip is Not Selected. Host interface signals are ignored by the controller. |
| 39-42 | See Function Column | - | - | XR (X+): Right YD (Y-): Down XL (X-): Left YU (Y+): Up |
| 43 | A ₁ (LED+) | - | - | Supply Pin for LED. "A" (anode) or "+" of LED backlight. |
| 44-49 | LEDK ₁ -LEDK ₆ (LED-) | - | - | Individual supply pins for LED. "K" (cathode or kathode for German and original Greek spelling), or "-" of LED backlight. |
| 50 | GND | - | - | Ground. |

7. Touch Screen Connections (4-Wire Analog)



NOTE: The touch screen must be driven in one direction, then read in the other direction.

7.1. ESD (ELECTRO-STATIC DISCHARGE)

The circuitry is industry standard CMOS logic and is susceptible to ESD damage. Please use industry standard antistatic precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.

8. Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit | Notes |
|--|------------------------|------|------------------------------|------|--------|
| Digital Logic Supply and Input/Output Supply | $V_{\text{LOGIC I/O}}$ | -0.3 | +4.6 | V | (1)(2) |
| Analog Supply | V_{ANALOG} | -0.3 | +4.6 | V | (1)(2) |
| Operating Temperature | T_{OP} | -20 | +70 | °C | - |
| Storage Temperature | T_{ST} | -30 | +80 | °C | - |
| Humidity | RH | 0 | 90 | % | - |
| Input Voltage | V_{IN} | -0.3 | $V_{\text{LOGIC I/O}} + 0.3$ | V | - |

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 | Min | Typical | Max | Unit |
|--|------------------------|-----------------------------------|-----------|-----------------------------------|------|
| Digital Logic Supply and Input/Output Supply | $V_{\text{LOGIC I/O}}$ | +1.7 | +1.8/+3.3 | +3.3 | V |
| Analog Supply | V_{ANALOG} | +2.5 | +3.3 | +3.3 | V |
| Current Consumption for Normal Operation | V_{OP} | - | 10 | - | mA |
| High-level Input | V_{IH} | $0.7 \times V_{\text{LOGIC I/O}}$ | - | $V_{\text{LOGIC I/O}}$ | V |
| Low-level Input | V_{IL} | 0v (GND) | - | $0.3 \times V_{\text{LOGIC I/O}}$ | V |
| High-level Output @0.1mA | V_{OH} | $0.8 \times V_{\text{LOGIC I/O}}$ | - | $V_{\text{LOGIC I/O}}$ | V |
| Low-level Output @0.1mA | V_{OL} | 0v (GND) | - | $0.2 \times V_{\text{LOGIC I/O}}$ | V |

10. Optical Characteristics

| Item | Symbol | Condition | Min | Typical | Max | Unit |
|---------------------------|---------------|------------------------|-------|---------|-------|------|
| Color Depth | - | - | - | 262 | - | K |
| Contrast Ratio | CR | - | - | 500 | - | - |
| TFT Response Time | T rise | - | - | 5 | - | ms |
| | T fall | | - | 15 | - | ms |
| Red Chromaticity | x | - | 0.611 | 0.641 | 0.671 | ms |
| | y | | 0.290 | 0.320 | 0.350 | ms |
| Green Chromaticity | x | - | 0.270 | 0.300 | 0.330 | ms |
| | y | | 0.536 | 0.566 | 0.596 | ms |
| Blue Chromaticity | x | - | 0.104 | 0.134 | 0.164 | ms |
| | y | | 0.098 | 0.128 | 0.158 | ms |
| White Chromaticity | x | - | 0.267 | 0.297 | 0.327 | ms |
| | y | | 0.301 | 0.331 | 0.361 | ms |
| Viewing Angle, Horizontal | θ_{x+} | Center CR \geq 10 | - | 70 | - | ° |
| | θ_{x-} | | | 70 | | |
| Viewing Angle, Vertical | θ_{y+} | | - | 60 | - | ° |
| | θ_{y-} | | | 60 | | |
| Viewing Direction | 6 o'clock | | | | | |

11. Backlight Characteristics

| Parameter | Symbol | Minimum | Typical | Maximum | Unit |
|--|-----------|---------|---------|---------|-------------------|
| Supply Current | I_{LED} | - | 90 | - | mA |
| Supply Voltage | V_{LED} | - | +3.2 | - | V |
| Luminous Intensity $I_{LED} - 25mA$ | I_v | - | 85 | - | cd/m ² |
| Uniformity | - | 80 | - | - | % |
| LED Lifetime | - | - | 50K | - | Hrs |

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

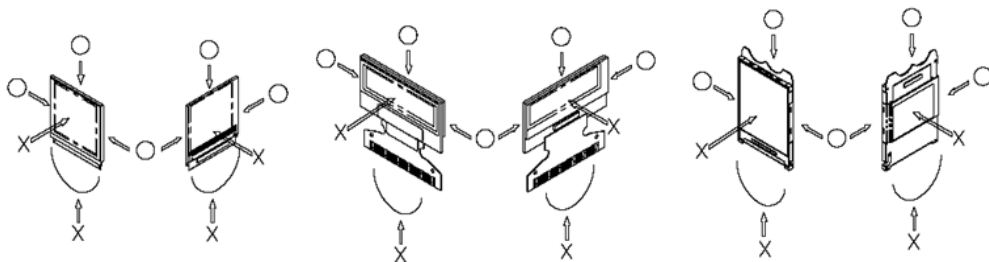
The precautions below should be followed when using LCD modules to help ensure personal safety, module performance, and compliance of environmental regulations.

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:

