TFT GRAPHIC DISPLAY MODULE DATASHEET

Datasheet Release Date 2024-02-15
for
CFAF240320J0-028TR

Crystalfontz America, Inc.

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1. General Information

Datasheet Revision History
Datasheet Release: **2024-02-15** Datasheet for the CFAF240320J0-028TR 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 full color TFT graphic display module with a white LED backlight. This display has a built-in Sitronix ST7789V controller.

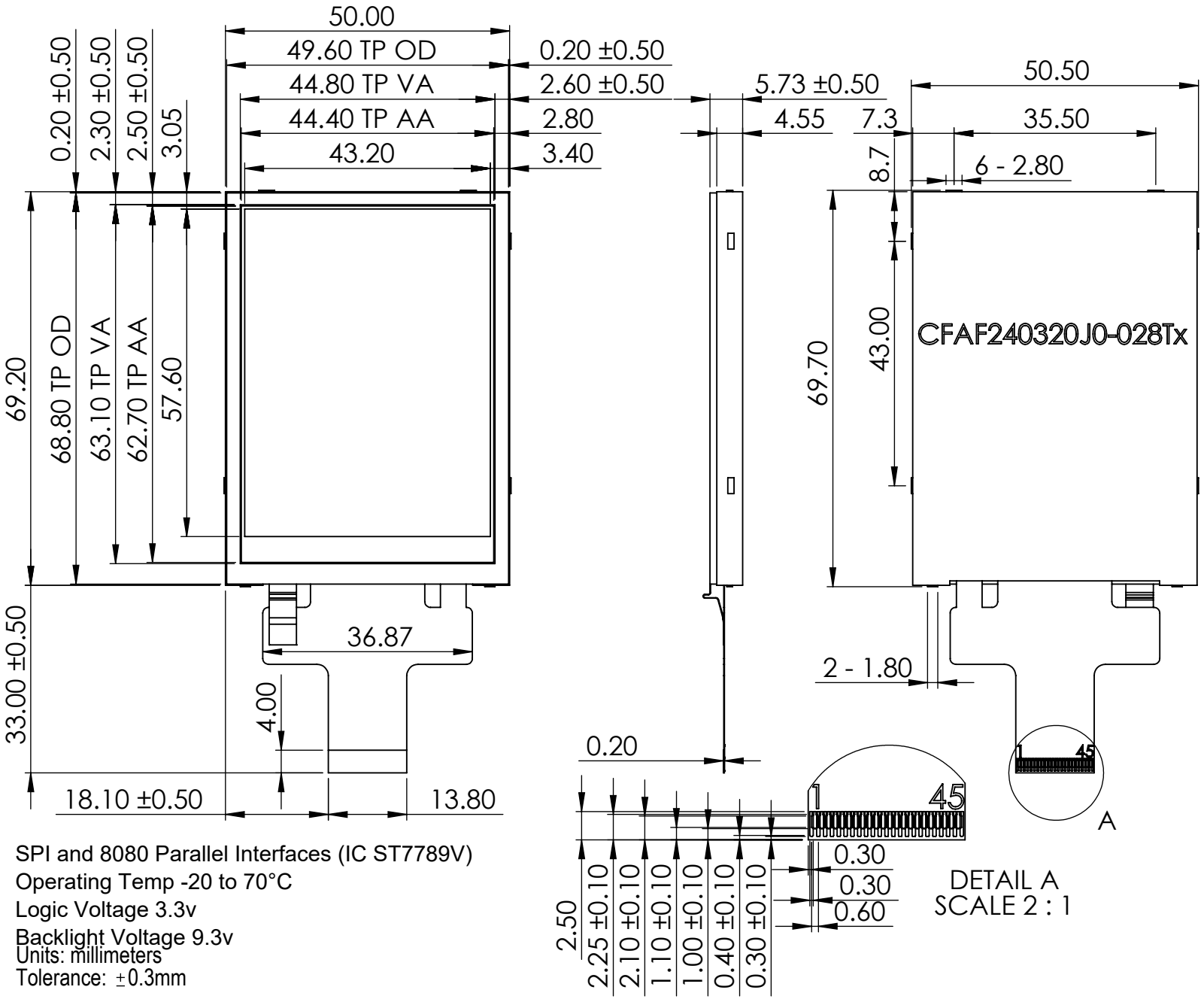
Please see the Sitronix ST7789V datasheet for further reference.

3. Features

- 240*320 Dot Matrix
- Viewing Direction: All (IPS)
- Built-in Controller: Sitronix ST7789V (or equivalent)
- Operating Temperature: -20 - 70°C
- Storage Temperature: -30 - 80°C
- +3.3V Power Supply
- Interface: 8/9/16/18 bit parallel, RGB, 3- and 4- Wire SPI
- Resistive touch panel

4. Mechanical Data

Item	Specification (mm)	Specification (inch, reference)
Overall Width and Height	50.5 (W) x 69.7 (H) x 5.73 (D)	1.99 (W) x 2.74 (H) x 0.23 (D)
Active Area	43.2 (W) x 57.6 (H)	1.70 (W) x 2.27 (H)
Dot Pitch	0.18 (W) x 0.18 (H)	0.007 (W) x 0.007 (H)
Weight (Typical)	28.5 grams	1 ounce



Pin No.	Symbol
1	LED_A
2	LED_K
3	VCC
4	SDO
5	TE
6-23	DB17-0
24	SDA
25	GND
26	DOTCLK
27	GND
28	ENABLE
29	VSYNC
30	HSYNC
31	RD
32	WR
33	DC
34	CS
35	RESET
36	IM0
37	IM1
38	IM2
39	VCI
40-41	GND
42-45	Touch

SPI and 8080 Parallel Interfaces (IC ST7789V)
Operating Temp -20 to 70°C
Logic Voltage 3.3v
Backlight Voltage 9.3v
Units: millimeters
Tolerance: ±0.3mm

Crystalfontz

Part Number:	Date:	Filename:	Revision:
CFAF240320J0-028TR	2/8/2024	CFAF240320J0-028TR.pdf	1.0
	Web: www.crystalfontz.com/CFAF240320J0-028TR		Sheet: 1 of 1

6. Interface Pin Function

<table>
<tr><th>Pin No.</th><th>Symbol</th><th>SPI Interface</th><th>8080 Parallel Interface</th><th>RGB Interface</th></tr>
<tr><td>1</td><td>LED_A</td><td colspan="3">LED backlight power anode</td></tr>
<tr><td>2</td><td>LED_K</td><td colspan="3">LED backlight power cathode</td></tr>
<tr><td>3</td><td>V_{CC}</td><td colspan="3">Digital power supply</td></tr>
<tr><td>4</td><td>SDO</td><td>Serial data output, data output on falling edge of SCL</td><td colspan="2">No Connection</td></tr>
<tr><td>5</td><td>TE</td><td colspan="3">Tearing effect output pin, no connection if not used</td></tr>
<tr><td>6-23</td><td>DB0-17</td><td>Fix low</td><td><table><tr><th>16-bit</th><th>8-bit</th><th>18-bit</th><th>9-bit</th></tr><tr><td>DB[17:10] DB[8:1]</td><td>DB[17: 10]</td><td>DB[17: 0]</td><td>DB[17: 9]</td></tr></table>Note: Data bus Pin 6 is DB17 through to Pin 23 being DB0</td><td>RGB Interface Bus
6-bit RGB use DB[5:0]
16-bit RGB use DB[17:13] and [11:1]
18-bit RGB use DB[17:0]</td></tr>
<tr><td>24</td><td>SDA</td><td>Serial data input. Data latched on rising edge of SCL</td><td colspan="2">Fix low</td></tr>
<tr><td>25</td><td>GND</td><td colspan="3">Ground</td></tr>
<tr><td>26</td><td>DOTCLK</td><td colspan="2">Fix low</td><td>Dot clock signal for RGB interface</td></tr>
<tr><td>27</td><td>GND</td><td colspan="3">Ground</td></tr>
<tr><td>28</td><td>ENABLE</td><td colspan="2">Fix low</td><td>Data enable for RGB interface</td></tr>
<tr><td>29</td><td>VSYNC</td><td colspan="2">Fix low</td><td>Vertical synchronizing input</td></tr>
<tr><td>30</td><td>HSYNC</td><td colspan="2">Fix low</td><td>Horizontal synchronizing input</td></tr>
<tr><td>31</td><td>$\overline{RD}$</td><td>Fix low</td><td>Read enable, active low</td><td>Fix low</td></tr>
<tr><td>32</td><td>$\overline{WR}$</td><td>Select between data (high) and command (low) registers, fix low if unused</td><td>Write enable, enable low</td><td>Fix low</td></tr>
<tr><td>33</td><td>D/$\overline{C}$</td><td>SCL – Serial interface clock</td><td>Select between the data (high) and command (low) registers</td><td>Fix low</td></tr>
<tr><td>34</td><td>$\overline{CS}$</td><td colspan="3">Chip select signal- low enable, high disable</td></tr>
<tr><td>35</td><td>RESET</td><td colspan="3">Reset signal, active low</td></tr>
<tr><td>36</td><td>IM0</td><td rowspan="3"><table><tr><th>3-Wire</th><th>4-Wire</th></tr><tr><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td></tr></table></td><td rowspan="3"><table><tr><th>16-bit</th><th>8-bit</th><th>18-bit</th><th>9-bit</th></tr><tr><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td></tr></table></td><td></td></tr>
<tr><td>37</td><td>IM1</td><td></td></tr>
<tr><td>38</td><td>IM2</td><td></td></tr>
<tr><td>39</td><td>V_{CI}</td><td colspan="3">Analog power supply</td></tr>
<tr><td>40-41</td><td>GND</td><td colspan="3">Ground</td></tr>
<tr><td>42</td><td>YU</td><td colspan="3">Touch, top of display</td></tr>
<tr><td>43</td><td>XL</td><td colspan="3">Touch, left of display</td></tr>
<tr><td>44</td><td>YD</td><td colspan="3">Touch, bottom of display</td></tr>
<tr><td>45</td><td>XR</td><td colspan="3">Touch, right of display</td></tr>
</table>

7. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Operating Temperature	T_{OP}	-20	+70	°C
Storage Temperature	T_{STG}	-30	+80	°C

Note: These are stress ratings only. Extended exposure to the absolute maximum 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.

8. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Digital	V_{CC}	-	3.0	3.3	3.6	V
Supply Voltage for Analog	V_{CI}	-	1.65	1.8	3.6	V
High-level Input	V_{IH}	-	0.7 x V_{CC}	-	V_{CC}	V
Low-level Input	V_{IL}	-	V_{SS}	-	0.3 x V_{CC}	V
Power Supply Current for LCM	I_{CC}	V_{CI} = V_{CC} = 3.3V	-	6.3	9.5	mA

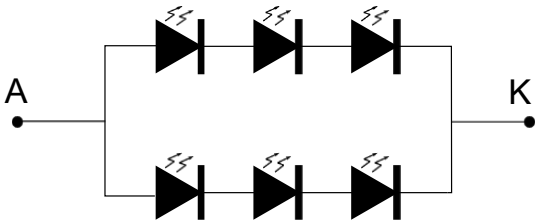
9. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V)θ	-	-	160	-	deg
	(H)φ	-	-	160	-	deg
Contrast Ratio	CR	Normal Viewing Angle	600	800	-	-
Response Time	T_{Rise}+T_{Fall}	-	-	30	40	ms
Brightness, center of display			250	350	-	cd/m2
Uniformity	T	-	75	-	-	%

10. LED Backlight

Item	Condition	Symbol	Min	Typ	Max	Unit
Forward Current		I_F	-	80	-	mA
Forward Voltage		V_F	8.1	9.3	10.5	V
Uniformity for LCM		-	70	-	-	%
LED Lifetime		-	50K	-	-	Hours
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 (20K hours is an estimate for reference only).



11. Touch Panel Specifications

Item	Specification (mm)
Driving Condition	DC5V
Operating force	20-100g
Linearity max	≤1.5%
Insulating resistance	>20MΩ, 25V DC
Light transparence	70%
Structure type	ITO Film/ITO Glass
Surface Hardness	3H typ
Durability (with silicon rubber)	>1,000,000 times
X resistance	150-500Ω
Y resistance	350-900Ω

12. LCD Module Precautions

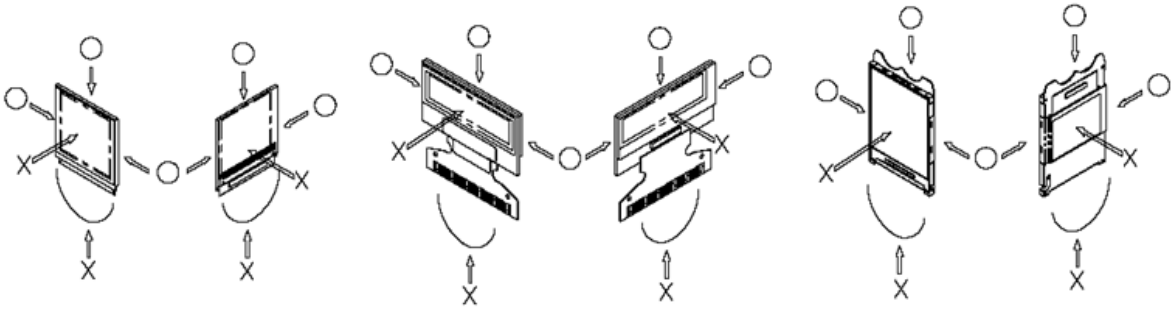
These precautions help ensure personal safety, module performance, and compliance of environmental regulations when using an LCD module.

12.1. 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.

12.2. 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.

12.3. 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.

12.4. 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.

12.5. Disposing Precautions

- Request qualified companies handle the industrial waste when disposing of the LCD display modules. Observe all relevant 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 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.
- The limitation of FPC bending: