



CFAF240400C1-030TC IPS TFT DISPLAY MODULE DATASHEET



Datasheet Release Date **2022-08-29**
for
CFAF240400C1-030TC

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1. General Information

Datasheet Revision History

Datasheet Release: **2022-08-29**
Datasheet for the CFAF240400C1-030TC 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 IPS TFT graphic display module with a white LED backlight and built in capacitive touch screen. This display is also designed with a ZIF tail for easy PCA integration.

This display has a selectable color resolution between an 8-color span, a 65k-color span, and a 262k-color span.

This display has a built-in Sitronix ST7796 controller; see the [Sitronix ST7796 controller datasheet](#) for further reference including controller command sets and settings descriptions.

3. Features

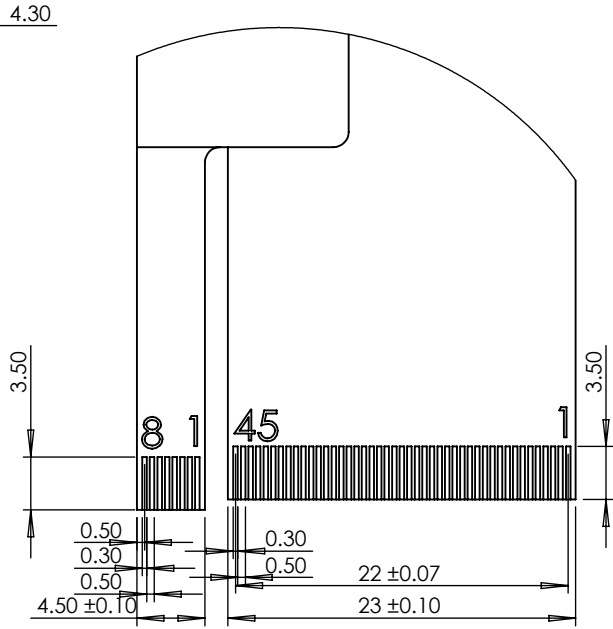
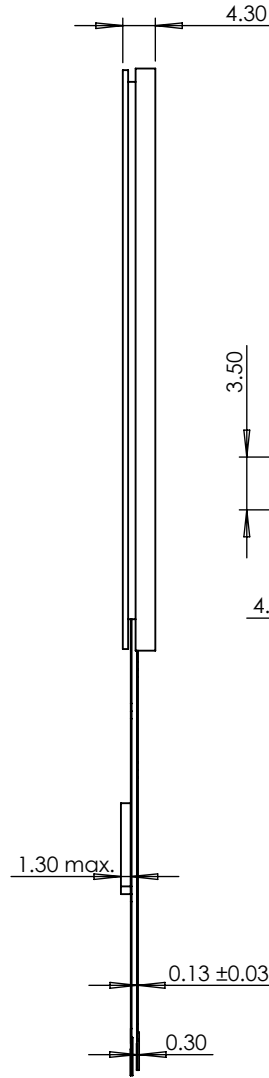
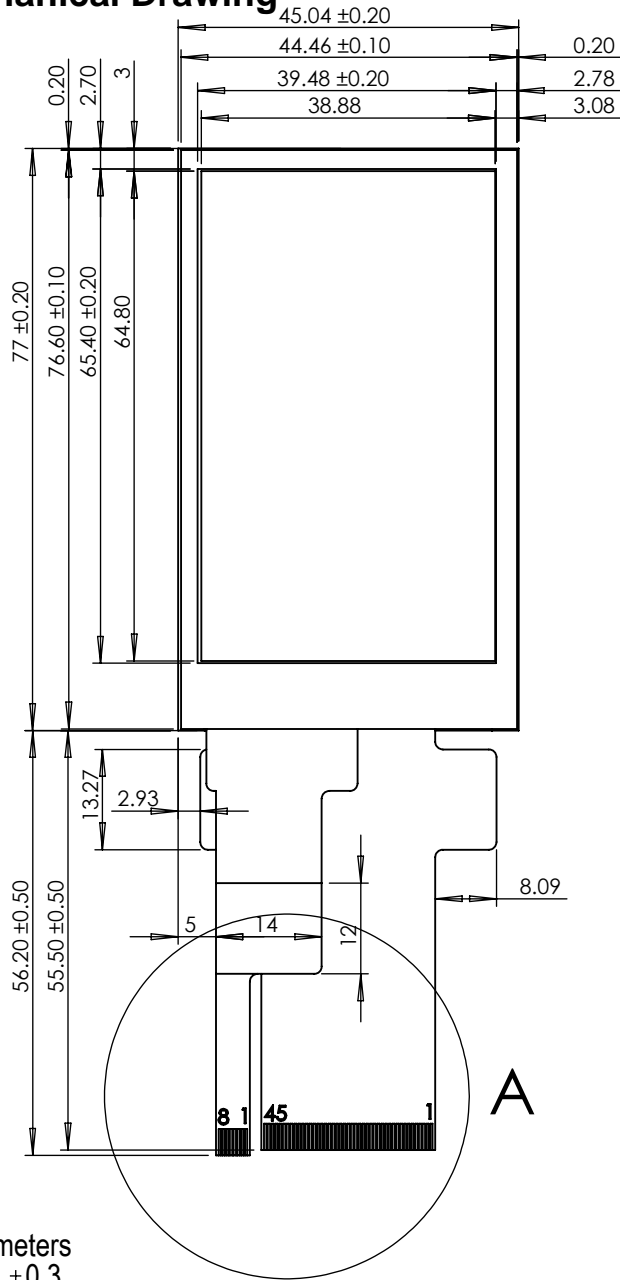
- 240*400 Dot Matrix
- White LED Backlight
- IPS - Any Angle Viewing Direction
- Built-in Display Controller: Sitronix ST7796
- Built-in Touch Controller: Focal Tech FT5436
- Operating Temperature: -20°C ~+70°C
- Storage Temperature: -30°C~+80°C
- +3.3V Power Supply
- Interfaces:
 - 8/9/16/18-bit MCU
 - SPI initialization + 16/18-bit RGB
 - 3- or 4-wire SPI

4. Mechanical Data

| Item | Specification (mm) |
|--------------------------|---------------------------------|
| Overall Width and Height | 45.04 (W) x 77.00 (H) x 4.3 (D) |
| Viewing Area | 39.48 (W) x 65.40 (H) |
| Active Area | 38.88 (W) x 64.80 (H) |
| Dot Pitch | 0.162 (W) x 0.162 (H) |
| Weight (Typical) | 26 |



11. Mechanical Drawing



DETAIL A
SCALE 2 : 1

| Pin | Desc |
|-------|----------|
| 1-3 | IM0-IM2 |
| 4 | RESET |
| 5 | VSYNC |
| 6 | HSYNC |
| 7 | PCLK |
| 8 | DE |
| 9-26 | DB17-DB0 |
| 27 | SDO |
| 28 | SDA |
| 29 | RD |
| 30 | WR/SCL |
| 31 | RS |
| 32 | CS |
| 33-34 | VCC |
| 35-36 | GND |
| 37-40 | LEDK |
| 41 | LEDA |
| 42-45 | NC |

| Touch | Desc |
|-------|-------|
| 1 | GND |
| 2 | VDDIO |
| 3 | VDD |
| 4 | SCL |
| 5 | SDA |
| 6 | INT |
| 7 | RST |
| 8 | GND |

| | |
|-----------------------|-------------|
| Display Controller | ST7796S |
| Touch Controller | FT5436 |
| Brightness | 350 |
| Viewing Direction | Free (IPS) |
| Operating Temperature | -20 to 70 C |
| Voltage Levels | 3.3v |

| IM0 (pin 1) | IM1 (pin 2) | IM2 (pin 3) | Interface | Databus pins |
|-------------|-------------|-------------|-----------------|------------------|
| 0 | 0 | 0 | 18-bit parallel | DB17-DB0 |
| 1 | 0 | 0 | 9-bit parallel | DB8-DB0 |
| 01 | 1 | 0 | 16-bit parallel | DB15-DB0 |
| 1 | 1 | 0 | 8-bit parallel | DB7-DB0 |
| 1 | 0 | 1 | 3-wire SPI | SDA, SCL, CS |
| 1 | 1 | 1 | 4-wire SPI | SDA, SCL, CS, RS |

Units: millimeters
Tolerance: ±0.3





6. Interface Pin Tables

6.1. Display Pin Table

| PIN No. | Symbol | Function | | | | | | | | | | | | | | | |
|--------------------------------------|-----------|---|----------------|------------------|-----------------|-----------------|--------------|---|---|---|-----------------|------------------|---|---|---|----------------|-------|
| 1 | IM0 | <table border="1"> <thead> <tr> <th>IM0</th> <th>IM1</th> <th>IM2</th> <th>Interface</th> <th>DB Pins</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>18-bit parallel</td> <td>DB17-0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>9-bit parallel</td> <td>DB8-0</td> </tr> </tbody> </table> | IM0 | IM1 | IM2 | Interface | DB Pins | 0 | 0 | 0 | 18-bit parallel | DB17-0 | 1 | 0 | 0 | 9-bit parallel | DB8-0 |
| | | IM0 | IM1 | IM2 | Interface | DB Pins | | | | | | | | | | | |
| | | 0 | 0 | 0 | 18-bit parallel | DB17-0 | | | | | | | | | | | |
| 1 | 0 | 0 | 9-bit parallel | DB8-0 | | | | | | | | | | | | | |
| 2 | IM1 | <table border="1"> <tbody> <tr> <td>0</td> <td>1</td> <td>0</td> <td>16-bit parallel</td> <td>DB15-0</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>8-bit parallel</td> <td>DB7-0</td> </tr> </tbody> </table> | 0 | 1 | 0 | 16-bit parallel | DB15-0 | 1 | 1 | 0 | 8-bit parallel | DB7-0 | | | | | |
| | | 0 | 1 | 0 | 16-bit parallel | DB15-0 | | | | | | | | | | | |
| 1 | 1 | 0 | 8-bit parallel | DB7-0 | | | | | | | | | | | | | |
| 3 | IM2 | <table border="1"> <tbody> <tr> <td>1</td> <td>0</td> <td>1</td> <td>3-Wire SPI</td> <td>SDA, SCL, CS</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>4-Wire SPI</td> <td>SDA, SCL, CS, RS</td> </tr> </tbody> </table> | 1 | 0 | 1 | 3-Wire SPI | SDA, SCL, CS | 1 | 1 | 1 | 4-Wire SPI | SDA, SCL, CS, RS | | | | | |
| | | 1 | 0 | 1 | 3-Wire SPI | SDA, SCL, CS | | | | | | | | | | | |
| 1 | 1 | 1 | 4-Wire SPI | SDA, SCL, CS, RS | | | | | | | | | | | | | |
| For RGB, select 3-Wire or 4-Wire SPI | | | | | | | | | | | | | | | | | |
| 4 | RESET | Active LOW Reset. This signal must be applied to properly initialize the chip. | | | | | | | | | | | | | | | |
| 5 | VSYNC | RGB Vertical Sync for frame synchronizing in RGB mode. If not used, set to GND | | | | | | | | | | | | | | | |
| 6 | HSYNC | RGB Horizontal Sync for line synchronizing in RGB mode. If not used, set to GND | | | | | | | | | | | | | | | |
| 7 | PCLK | RGB Pixel Clock. Dot clock signal for RGB mode. If not used, set to GND | | | | | | | | | | | | | | | |
| 8 | DE | RGB Data Enable signal for RGB mode. If not used, set to GND | | | | | | | | | | | | | | | |
| 9-26 | DB17- DB0 | RGB and MCU Bi-directional data bus pins for MCU and RGB modes. If not used, set to GND | | | | | | | | | | | | | | | |
| 27 | SDO | SPI Serial Data Output for SPI. If not used, leave open. | | | | | | | | | | | | | | | |
| 28 | SDA | SPI Serial Data Input for SPI. Data is latched on the rising edge of the SCL signal Other If not used, set to GND. | | | | | | | | | | | | | | | |
| 29 | RD | MCU Read signal, data latched on the rising edge. If not used, set to GND | | | | | | | | | | | | | | | |
| 30 | WR/SCL | MCU Write signal | | | | | | | | | | | | | | | |
| | | SPI Serial clock for SPI mode. Other If not used, set to GND | | | | | | | | | | | | | | | |
| 31 | RS | Register Select (Data/Command select) 1 = Data, 0 = Command | | | | | | | | | | | | | | | |
| 32 | CS | Chip Select Active LOW | | | | | | | | | | | | | | | |
| 33-34 | VCC | Supply Voltage 2.5V-3.6V | | | | | | | | | | | | | | | |
| 35-36 | GND | Ground | | | | | | | | | | | | | | | |
| 37 | LEDK4 | LED 4 Cathode | | | | | | | | | | | | | | | |
| 38 | LEDK3 | LED 3 Cathode | | | | | | | | | | | | | | | |
| 39 | LEDK2 | LED 2 Cathode | | | | | | | | | | | | | | | |
| 40 | LEDK1 | LED 1 Cathode | | | | | | | | | | | | | | | |
| 41 | LEDA | LED Anode | | | | | | | | | | | | | | | |
| 42 | XR | NC | | | | | | | | | | | | | | | |
| 43 | YD | NC | | | | | | | | | | | | | | | |
| 44 | XL | NC | | | | | | | | | | | | | | | |
| 45 | YU | NC | | | | | | | | | | | | | | | |

Note:

(1) RGB is used in conjunction with SPI. See Appendix for detailed pinouts.

6.2. Interface Table

| IM0 | IM1 | IM2 | Function | Data Pins in Use |
|-----|-----|-----|------------------|------------------|
| 0 | 0 | 0 | 18-bit interface | DB17-DB0 |
| 0 | 0 | 1 | 9-bit interface | DB8-DB0 |
| 0 | 1 | 0 | 16-bit interface | DB15-DB0 |
| 0 | 1 | 1 | 8-bit interface | DB7-DB0 |
| 1 | 0 | 1 | 3-Wire SPI | SDA, SCL, CS |
| 1 | 1 | 1 | 4-Wire SPI | SDA, SCL, CS, RS |



6.3. Capacitive Touch Pin Table

| PIN No. | Symbol | Function |
|---------|--------|--------------------------|
| 1 | GND | Ground |
| 2 | VDDIO | I/O Power Supply Voltage |
| 3 | VDD | Supply Voltage |
| 4 | SCL | I2C Clock |
| 5 | SDA | I2C Data Input/Output |
| 6 | INT | Interrupt to the Host |
| 7 | RESET | Reset Active LOW |
| 8 | GND | Ground |

6.4. Touch panel information

I2C address: 7-bit: 0x38
 8-bit: 0x70(Write) 0x71(Read)
 5-point touch
 Touch Controller IC: FT5436
 Structure: G+G

7. Absolute Maximum Ratings

| Parameter | Symbol | Min | Max | Unit |
|-----------------------|------------------|------|-----|------|
| Supply Voltage | V _{CC} | -0.3 | 4.6 | V |
| 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 | Min | Typ | Max | Unit |
|---------------------|-----------------|-----------------------|-----|-----------------------|------|
| Supply Voltage | V _{CC} | 2.5 | 3.3 | 3.6 | V |
| High-level Input | V _{IH} | 0.7 x V _{CC} | - | V _{CC} | V |
| Low-level Input | V _{IL} | GND | - | 0.3 x V _{CC} | V |
| High-level Output | V _{OH} | 0.8 x V _{CC} | - | V _{CC} | V |
| Low-level Output | V _{OL} | GND | - | 0.2 x V _{CC} | V |
| Normal Mode Current | I _{DD} | - | 10 | 20 | mA |



9. Optical Characteristics

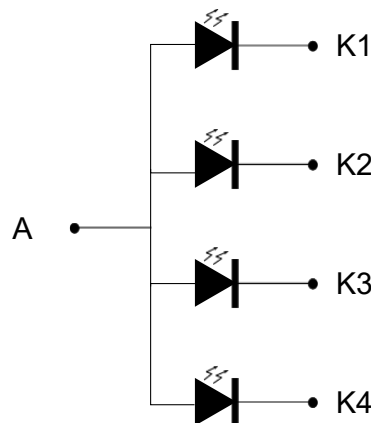
| Item | Symbol | Condition | Min | Typ | Max | Unit |
|----------------|-----------------------|------------|-------|-------|-------|------|
| View Angle | Left | CR>10 | - | 80 | - | deg |
| | Right | | - | 80 | - | deg |
| | Top | | - | 80 | - | deg |
| | Bottom | | - | 80 | - | deg |
| Contrast Ratio | CR | $\Theta=0$ | 400 | 600 | - | - |
| Response Time | $T_{rise} + T_{fall}$ | | - | 35 | - | ms |
| | White | W_x | 0.245 | 0.285 | 0.325 | |
| | | W_y | 0.271 | 0.311 | 0.351 | |
| | Red | R_x | 0.568 | 0.608 | 0.648 | |
| | | R_y | 0.315 | 0.355 | 0.395 | |
| | Green | G_x | 0.287 | 0.327 | 0.367 | |
| | | G_y | 0.535 | 0.575 | 0.615 | |
| | Blue | B_x | 0.114 | 0.154 | 0.194 | |
| | | B_y | 0.055 | 0.095 | 0.135 | |

10. Backlight Characteristics

| Item | Condition | Symbol | Min | Typ | Max | Unit |
|----------------------------|------------|--------|-----|-----|-----|-------------------|
| Supply Current | V=3.2v | I | 60 | 80 | - | mA |
| Forward Voltage | $I_F=80mA$ | V | - | 3.2 | - | V |
| Luminous Intensity for LCM | | I_v | 300 | 350 | - | cd/m ² |
| LED Lifetime | | - | 50K | - | - | Hr. |
| 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).





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

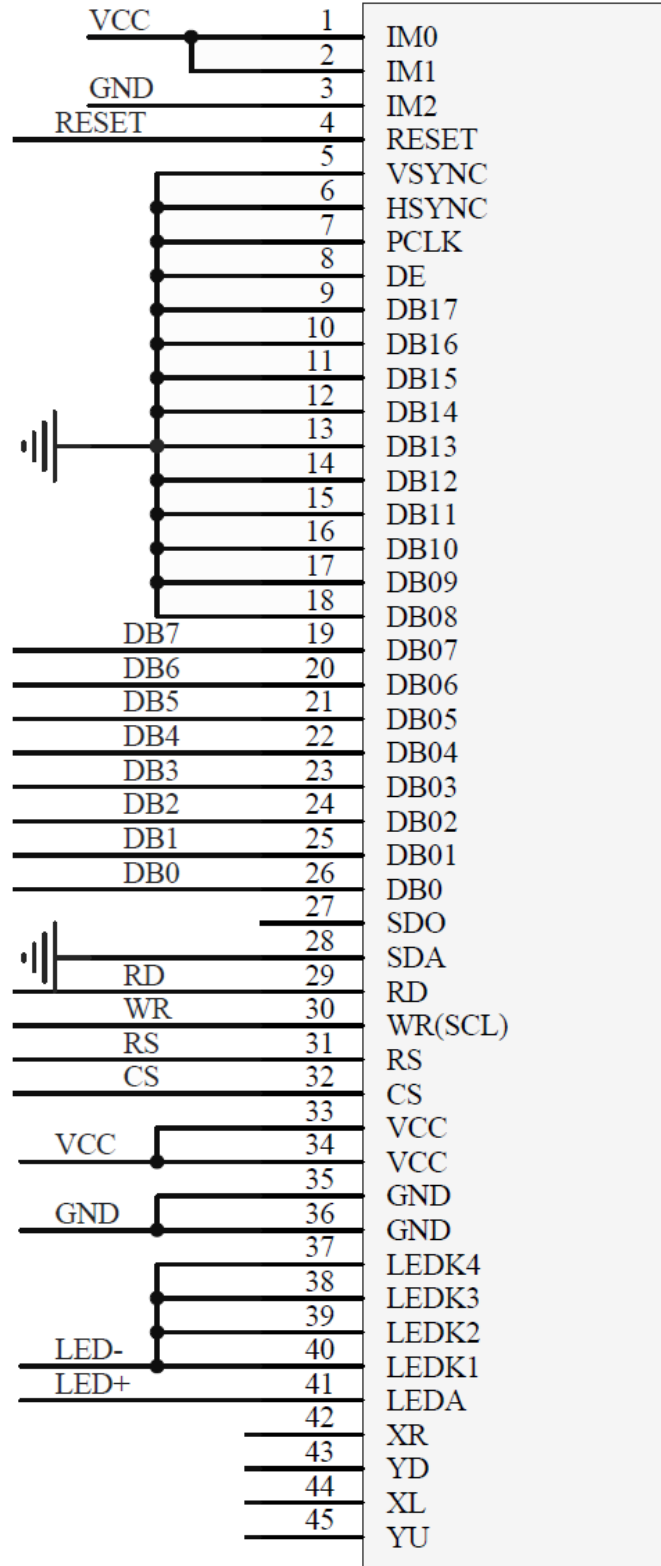
- Take care to not damage the glass display panel
- Avoid applying excessive shocks to the module or making any modifications to it.
- Avoid applying excessive shocks to the module or making any modifications to it.
- Do not make extra holes on the printed circuit board, modify its shape or change the components of the LCD display module.
- Do not disassemble the LCD module.
- Do not drop, bend or twist the LCD module.
- Do not operate the LCD module above its absolute maximum ratings described in this datasheet.
- Solder only to the I/O terminals. Use care when removing solder—it is possible to damage the PCB, for modules with an FPC, use an appropriate ZIF connector.
- Do not reverse polarity to the power supply connections. Reversing polarity will immediately ruin the module.
- Store LCD modules in a clean and static safe environment.
- Do not reverse polarity to the power supply connections. Reversing polarity will immediately ruin the module.

11.2. Handling Precautions

- Take care to not damage the glass display panel
- If the display panel is broken, organic liquid crystal may leak out, avoid bodily contact with this fluid and dispose of the broken module properly.
- Avoid the application of pressure to the display module, as pressure may damage the LCD module's cell structure.
- Polarizers installed on LCD modules are soft and susceptible to scratching, avoid contact between the polarizer and abrasive surfaces.
- Do not use any solvents or liquid to clean the LCD display module, should an LCD need cleaning, contaminants can be removed with plain office tape or oil free compressed air.
- Ensure any mounting solution of the LCD module secures the module fully and protects the module from mechanical stresses
- Do not operate LCD modules in the presence of excessive humidity or condensation
- Dispose of any electronic waste properly. Do not place this module in the normal trash. Please contact local waste management from procedures to dispose of electronic waste.
- Do not place weight or pressure on the module

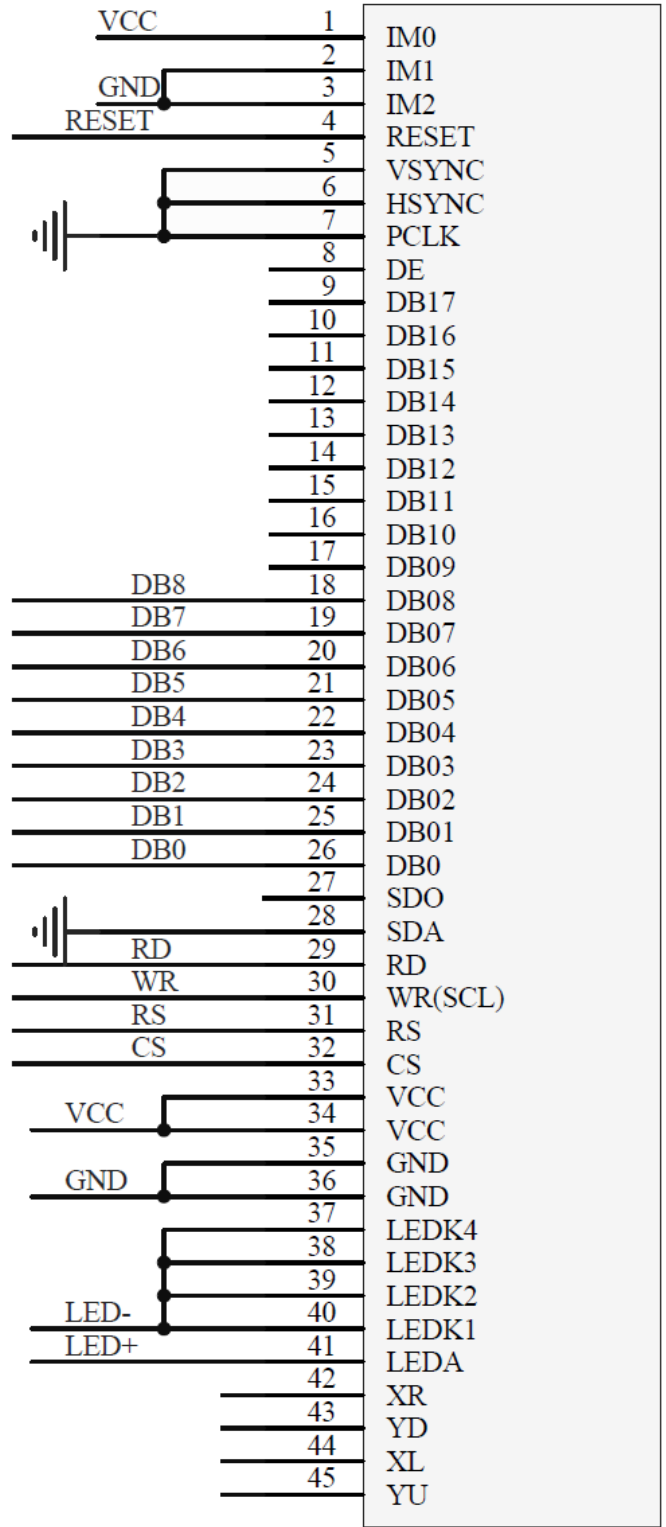


Appendix A: 8-bit Interface



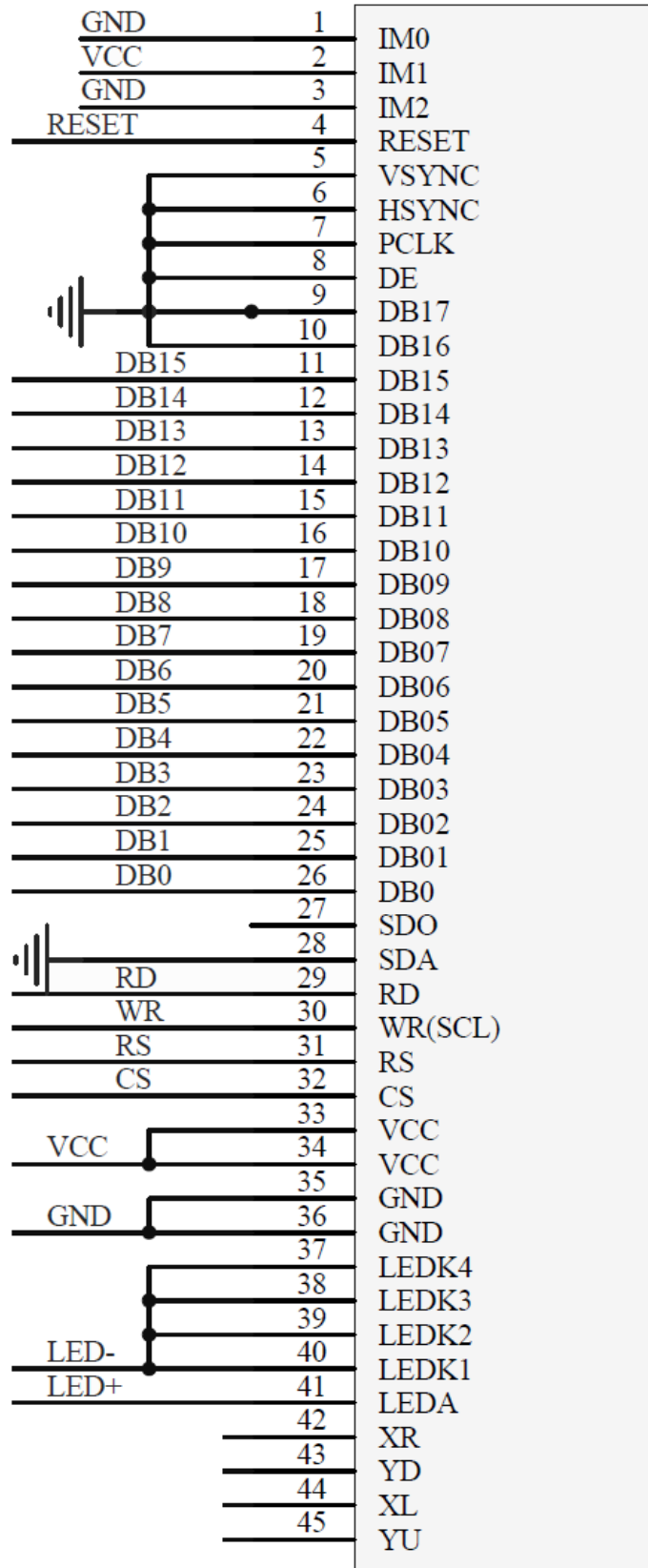


Appendix B: 9-bit Interface



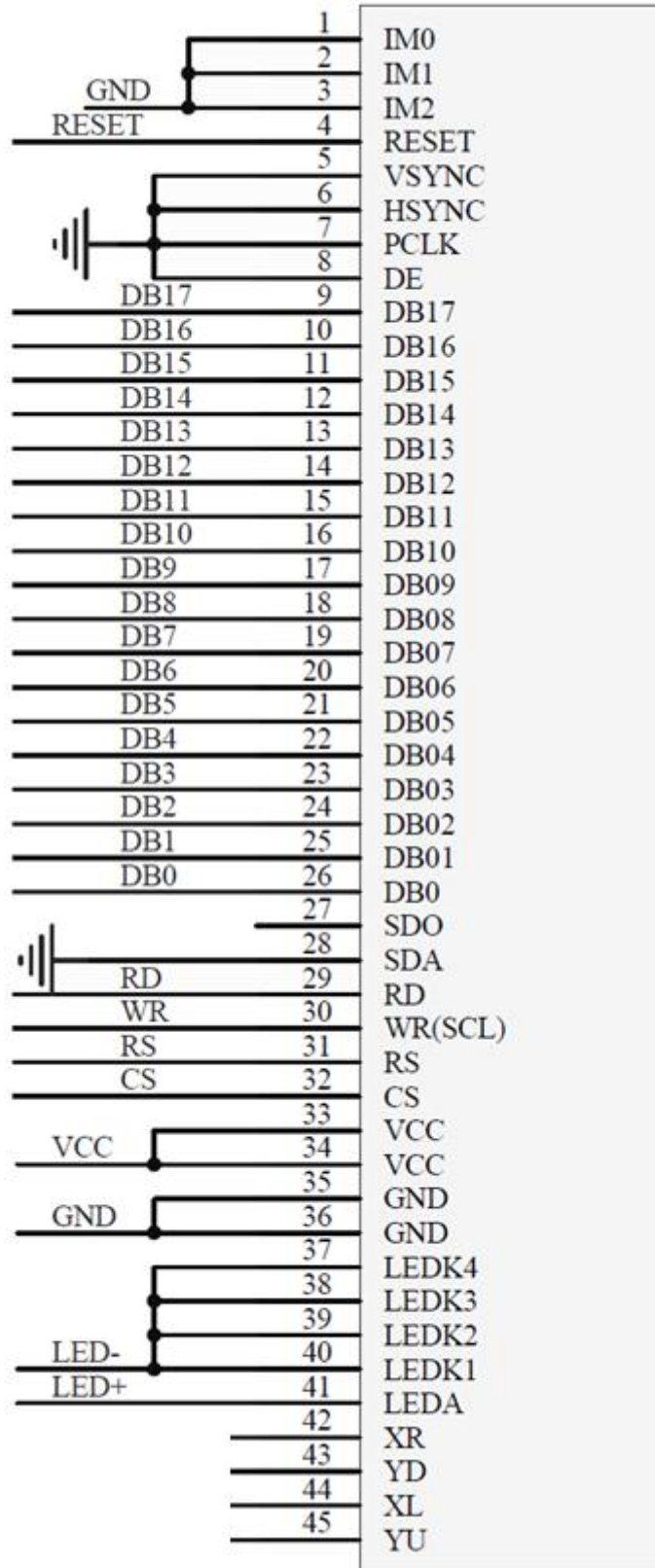


Appendix C: 16-bit Interface





Appendix D: 18-bit Interface





Appendix E: 3-Wire SPI + 16-bit RGB Interface

| | | |
|--------|----|---------|
| VCC | 1 | IM0 |
| GND | 2 | IM1 |
| VCC | 3 | IM2 |
| RESET | 4 | RESET |
| VSYNC | 5 | VSYNC |
| HSYNC | 6 | HSYNC |
| DOTCLK | 7 | PCLK |
| DEN | 8 | DE |
| R4 | 9 | DB17 |
| R3 | 10 | DB16 |
| R2 | 11 | DB15 |
| R1 | 12 | DB14 |
| R0 | 13 | DB13 |
| | 14 | DB12 |
| G5 | 15 | DB11 |
| G4 | 16 | DB10 |
| G3 | 17 | DB09 |
| G2 | 18 | DB08 |
| G1 | 19 | DB07 |
| G0 | 20 | DB06 |
| B4 | 21 | DB05 |
| B3 | 22 | DB04 |
| B2 | 23 | DB03 |
| B1 | 24 | DB02 |
| B0 | 25 | DB01 |
| | 26 | DB0 |
| SDA | 27 | SDO |
| | 28 | SDA |
| SCL | 29 | RD |
| | 30 | WR(SCL) |
| CS | 31 | RS |
| | 32 | CS |
| VCC | 33 | VCC |
| | 34 | VCC |
| GND | 35 | GND |
| | 36 | GND |
| | 37 | LEDK4 |
| | 38 | LEDK3 |
| | 39 | LEDK2 |
| LED- | 40 | LEDK1 |
| LED+ | 41 | LEDA |
| | 42 | |
| | 43 | XR |
| | 44 | YD |
| | 45 | XL |
| | | YU |



Appendix F: 3-Wire SPI + 18-bit Interface

| | | |
|--------|----|---------|
| VCC | 1 | IM0 |
| GND | 2 | IM1 |
| VCC | 3 | IM2 |
| RESET | 4 | RESET |
| VSYNC | 5 | VSYNC |
| HSYNC | 6 | HSYNC |
| DOTCLK | 7 | PCLK |
| DEN | 8 | DE |
| R5 | 9 | DB17 |
| R4 | 10 | DB16 |
| R3 | 11 | DB15 |
| R2 | 12 | DB14 |
| R1 | 13 | DB13 |
| R0 | 14 | DB12 |
| G5 | 15 | DB11 |
| G4 | 16 | DB10 |
| G3 | 17 | DB09 |
| G2 | 18 | DB08 |
| G1 | 19 | DB07 |
| G0 | 20 | DB06 |
| B5 | 21 | DB05 |
| B4 | 22 | DB04 |
| B3 | 23 | DB03 |
| B2 | 24 | DB02 |
| B1 | 25 | DB01 |
| B0 | 26 | DB0 |
| | 27 | SDO |
| SDA | 28 | SDA |
| | 29 | RD |
| SCL | 30 | WR(SCL) |
| | 31 | RS |
| CS | 32 | CS |
| | 33 | VCC |
| VCC | 34 | VCC |
| | 35 | GND |
| GND | 36 | GND |
| | 37 | LEDK4 |
| | 38 | LEDK3 |
| | 39 | LEDK2 |
| LED- | 40 | LEDK1 |
| LED+ | 41 | LEDA |
| | 42 | XR |
| | 43 | YD |
| | 44 | XL |
| | 45 | YU |



Appendix G: 4-Wire SPI + 16-bit Interface

| | | |
|--------|----|---------|
| VCC | 1 | IM0 |
| | 2 | IM1 |
| | 3 | IM2 |
| RESET | 4 | RESET |
| VSYNC | 5 | VSYNC |
| HSYNC | 6 | HSYNC |
| DOTCLK | 7 | PCLK |
| DEN | 8 | DE |
| R4 | 9 | DB17 |
| R3 | 10 | DB16 |
| R2 | 11 | DB15 |
| R1 | 12 | DB14 |
| R0 | 13 | DB13 |
| | 14 | DB12 |
| G5 | 15 | DB11 |
| G4 | 16 | DB10 |
| G3 | 17 | DB09 |
| G2 | 18 | DB08 |
| G1 | 19 | DB07 |
| G0 | 20 | DB06 |
| B4 | 21 | DB05 |
| B3 | 22 | DB04 |
| B2 | 23 | DB03 |
| B1 | 24 | DB02 |
| B0 | 25 | DB01 |
| | 26 | DB0 |
| SDA | 27 | SDO |
| | 28 | SDA |
| | 29 | RD |
| SCL | 30 | WR(SCL) |
| RS | 31 | RS |
| CS | 32 | CS |
| | 33 | VCC |
| VCC | 34 | VCC |
| | 35 | VCC |
| GND | 36 | GND |
| | 37 | GND |
| | 38 | LEDK4 |
| | 39 | LEDK3 |
| LED- | 40 | LEDK2 |
| LED+ | 41 | LEDK1 |
| | 42 | LEDA |
| XR | 43 | XR |
| YD | 44 | YD |
| XL | 45 | XL |
| YU | 45 | YU |

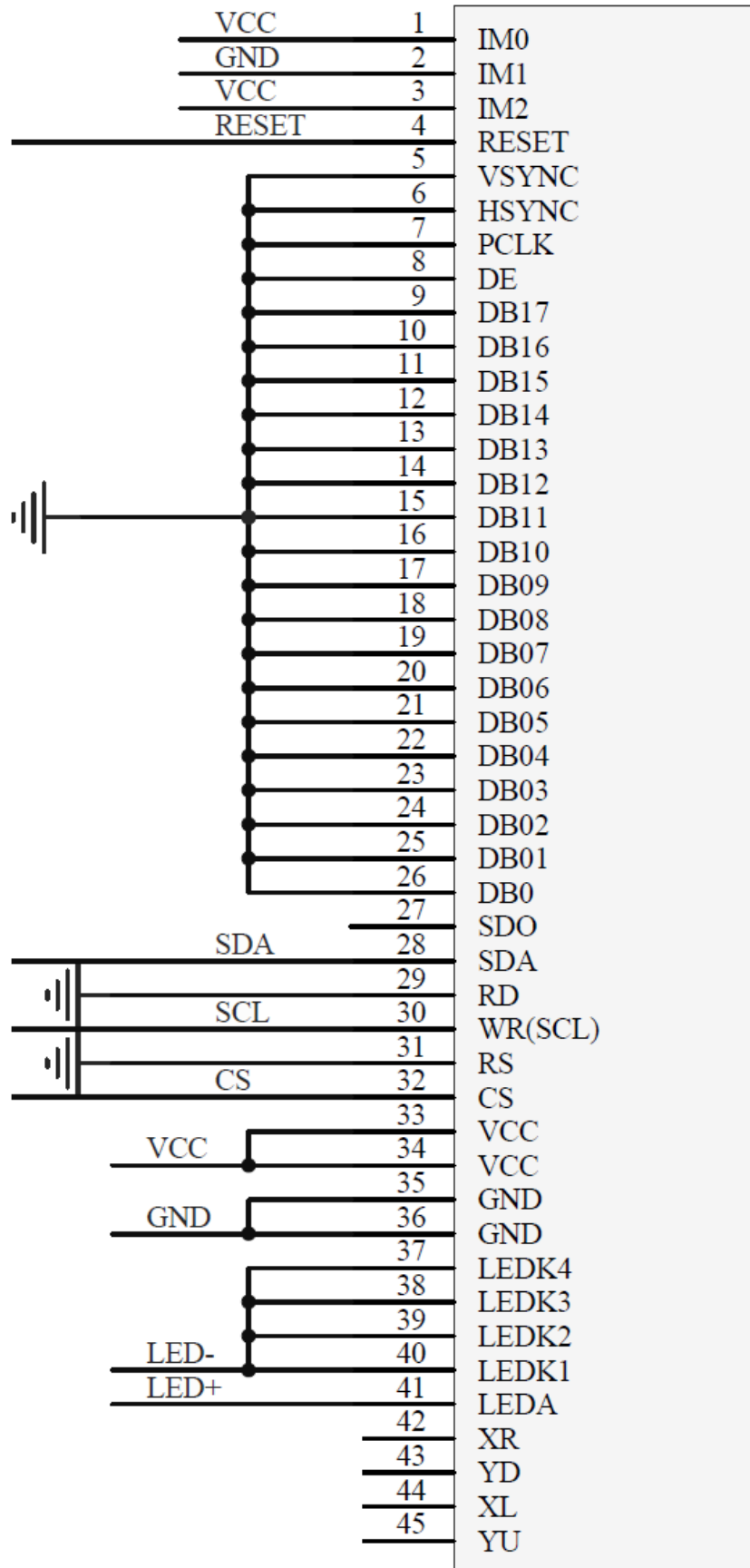


Appendix H: 4-Wire SPI +18-bit Interface

| | | |
|--------|----|---------|
| VCC | 1 | IM0 |
| | 2 | IM1 |
| | 3 | IM2 |
| RESET | 4 | RESET |
| VSYNC | 5 | VSYNC |
| HSYNC | 6 | HSYNC |
| DOTCLK | 7 | PCLK |
| DEN | 8 | DE |
| R5 | 9 | DB17 |
| R4 | 10 | DB16 |
| R3 | 11 | DB15 |
| R2 | 12 | DB14 |
| R1 | 13 | DB13 |
| R0 | 14 | DB12 |
| G5 | 15 | DB11 |
| G4 | 16 | DB10 |
| G3 | 17 | DB09 |
| G2 | 18 | DB08 |
| G1 | 19 | DB07 |
| G0 | 20 | DB06 |
| B5 | 21 | DB05 |
| B4 | 22 | DB04 |
| B3 | 23 | DB03 |
| B2 | 24 | DB02 |
| B1 | 25 | DB01 |
| B0 | 26 | DB0 |
| | 27 | SDO |
| SDA | 28 | SDA |
| | 29 | RD |
| SCL | 30 | WR(SCL) |
| RS | 31 | RS |
| CS | 32 | CS |
| | 33 | VCC |
| VCC | 34 | VCC |
| | 35 | GND |
| GND | 36 | GND |
| | 37 | LEDK4 |
| | 38 | LEDK3 |
| | 39 | LEDK2 |
| LED- | 40 | LEDK1 |
| LED+ | 41 | LEDA |
| XR | 42 | XR |
| YD | 43 | YD |
| XL | 44 | XL |
| YU | 45 | YU |



Appendix J: 3-Wire SPI Interface





Appendix K: 4-Wire SPI Interface

