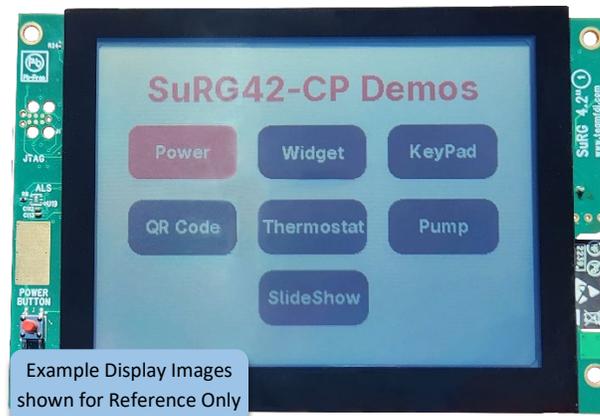# Sunlight Readable GUI (SuRG®) User's Manual

Covers the following products:

SuRG42-CP (Board Assembly)

SuRG42-CP-DK (Development Kit)

SuRG42-CP Main Menu

NOTICE: At FDI we are constantly improving our documentation. Please get the latest version of this document at https://www.teamfdi.com/product/surg42-cp-dk/#documentation

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Table of Contents

Document Revision History

Number	Change	Author	Manager	Date
1.0	Initial Release	Caleb Cox	Todd DeBoer	11/18/2025
1.1	Updated power numbers	Caleb Cox	Todd DeBoer	03/17/2026
1.2	Final review	Todd DeBoer	Todd DeBoer	03/18/2026

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1. Introduction

SuRG is FDI's family of low-power, sunlight-readable embedded GUI modules. The **SuRG family** offers a complete and fully qualified Graphical User Interface (GUI) and Human-Machine Interface (HMI) platform designed to accelerate product development and deployment.

With a crystal-clear, sunlight-readable LCD, SuRG's display pulls 95% less power than the typical backlit TFT LCD, making SuRG the perfect solution for outdoor and battery-powered applications. SuRG also features a PWM-controllable front light for use with low ambient lighting.

At the core of each SuRG device is an **STM32 U585 microcontroller**, supported by robust, software-integrated architecture. The software is based on the FreeRTOS operating system, chosen for its wide adoption and strong global community support.

2. Block Diagram

SuRG42-CP BLOCK DIAGRAM
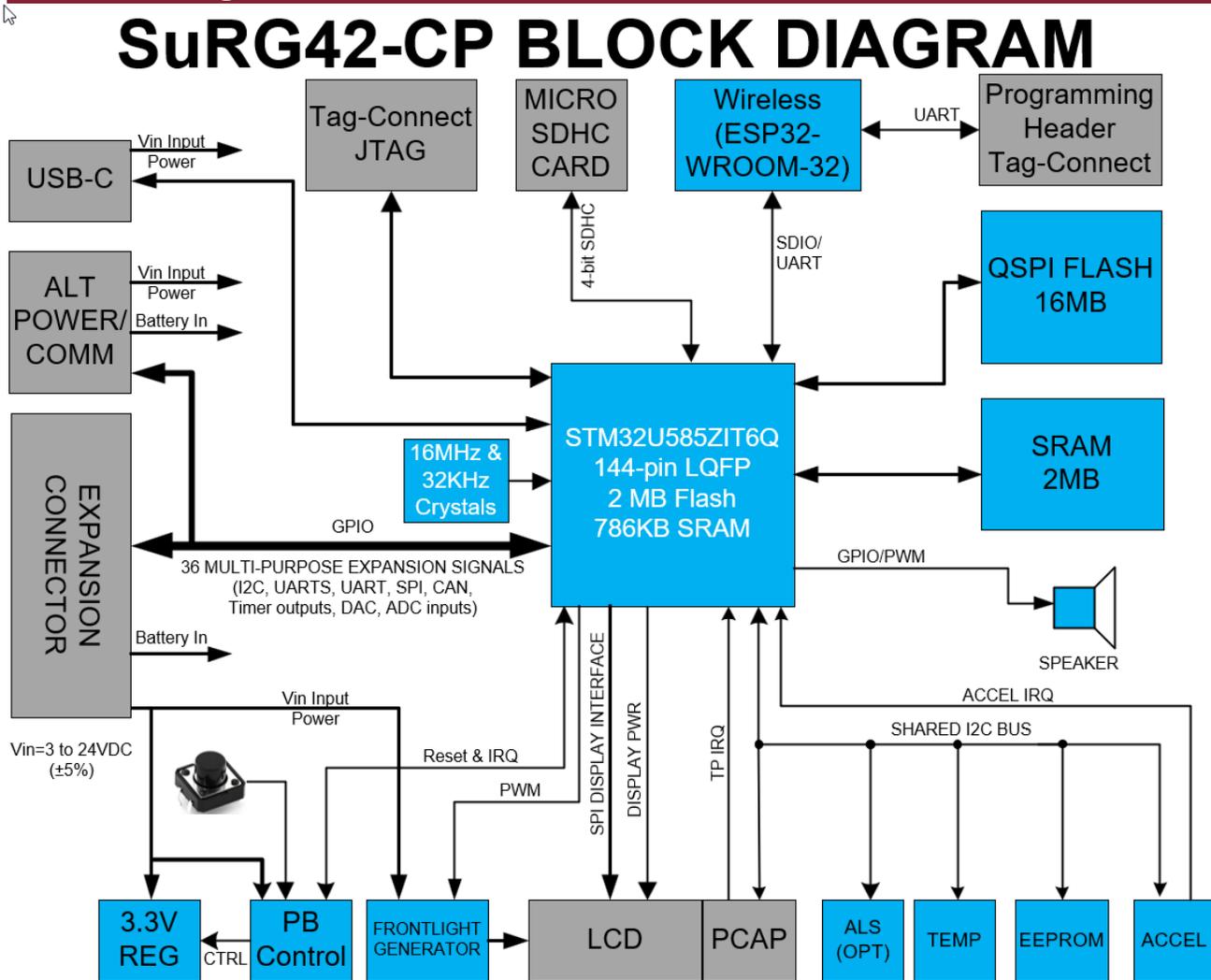
Rev 2

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3. Development Kit Contents (SuRG42-CP-DK)

- 4.2" PCAP Touch Screen LCD GUI Production Module (PN: SuRG42-CP)

- One USB Type A to USB Type C Cable

- AC to 5V USB Wall Power Adapter

- High Speed microSDHC Card (4GB or larger)

- J-Link Debugger/Programmer Probe (PN: J-link Lite CortexM-9)

- Tag-Connect 10 to 6 pin Cable with leg clamps

  (PN: TC2030-CTX 6-Pin Cable for ARM Cortex)

- One USB Type A to USB Type Mini-B Cable

- One SuRG Demo Board with Cable

4. Useful links

Complete User's Manuals, Schematics, and documentation are available on the Micro-SD card provided with the SuRG Kit and are also available from the following websites (please refer to the websites for the latest updates):

- Future Designs Support Page - https://www.teamfdi.com/support/
- User's manuals and QuickStart guides - https://www.teamfdi.com/product/surg42-cp/#documentation
- SuRG Source Code is on SourceForge- https://sourceforge.net/projects/fdi-surg/files
- Segger J-Link Debugger Software - https://www.segger.com/downloads/jlink/
- STM32CubeIDE - https://www.st.com/en/development-tools/stm32cubeide.html#st-get-software

5. Features

- STMU585 160 MHz Cortex-M33 based Microprocessor
- 2MB Internal Flash, 768KB Internal SRAM
- 2MB Ultra Low-Power SRAM
- 16MB QSPI Flash
- 128KB EEPROM
- RTC – Real Time Clock with battery backup
- Temperature Sensor
- Optional ALS Sensor
- Buzzer
- Micro SD Card Socket for up to 2 TB SDHC storage, microSD card included with kit only
- Mini JTAG
- Power-on Reset Generator - power-on reset supervisor and voltage monitor
- Expansion Connector for customer specific applications
- Operating Temperature -20°C to +70°C
- Input Voltage Range of 3.0 - 24VDC with a tolerance of ± 5%

6. Startup procedure

The SuRG Development Kit comes with a pre-installed micro-SD card that contains image files required for the Slide Show Demo.
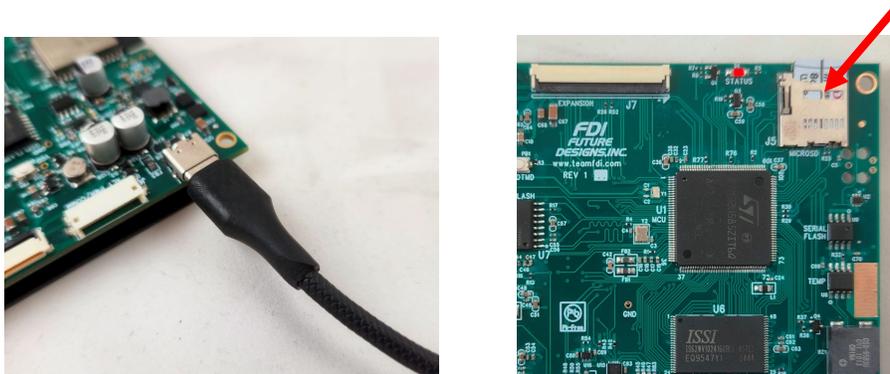
Figure 2 – Power Connector (P1) and SD Card Connector (J5)

Power is supplied via the USB Type-C connector, P1. Connect one end of the USB cable to a USB power supply or other USB power source and connect the other to the USB Type-C connector, P1. Once power is applied, press push button PB2 to turn on the SuRG unit.

Once power is supplied, you will see a screen like that shown in Figure 3.

Figure 3 – SuRG42-CP Screen.

The unit is now ready for software demonstrations and user operation.

7. Demonstration Software Main Menu

<u>Note: The Demonstration Software detailed below is subject to change at any time.</u>

The following software demonstrations are available from the Main Menu:

Navigation back to the Main Menu from any demo can be used from the back button at the top of the screen.

a) Power Demo

Clicking the Power Demo icon will load a demo that shows off SuRG's strongest feature – its low power consumption. This is demonstrated in three separate screens to indicate the current mode the SuRG is in:

- **Active Mode** –In this mode, the display can be updated, the touchscreen is active, the system responds to touch, memory is fully accessible, and the CPU is active. After 10 seconds or pressing on the IDLE mode button, the SuRG unit will transition to **Idle Mode**.

- **Idle Mode** –In Idle Mode, the LCD retains what was last written to it. The touchscreen, timers, and interrupts are all active and can be used to 'wake up' or transition the unit back to Active Mode. While in Idle Mode, memory is maintained and the SuRG unit draws as little as 4.5mW of Power.

- **Go to Power Down Mode** – When the power down button is pressed on the active screen, this temporary screen, displayed in **Active Mode**, shows information about SuRG until a timer, indicated by red text at the bottom of the screen expires. When the timer reaches 0, the unit enters **Power Down Mode.** The LCD, touchscreen, and CPU are disabled, but 2KB of internal SRAM and 2MB of external SRAM are retained. In this mode, SuRG draws as little as 80uW

b) Widget Demo

Clicking the Widget Demo icon demonstrates two screens utilizing a small selection of the different widgets that can be created using LVGL. Additionally, we wanted to show how quickly the LCD could be updated.

c) Keypad Demo

The Keypad Demo is a simple keyboard and text field demo to show off a keypad GUI and implementation. The purpose of this screen is to demonstrate the SuRG LCD's ability to receive precise touch inputs.

Note: To save data between power cycles, it is recommended to either write and read files to the microSD Card or write and read data to non-volatile memory.

d)   QR Code Demo

The QR Code Demo shows how the SuRG LCD is so clear that, even without a front light, a QR Code can be scanned using a cell phone to access a website. The QR Code in this demo takes the user to [FDI's website](#).

e)   Thermostat Demo

Clicking the Thermostat Demo icon loads a simple widget resembling a thermostat, with a radial temperature dial for temperature and a slider for fan speed. This demo shows the responsiveness of the SuRG touchscreen and its ability to interact with LVGL widgets.

f)   Pump Demo

The Pump Demo serves as a more real-world demonstration for SuRG. To setup for this demo, connect the included SuRG demo board to J6. Then, turning the dial sends an interrupt to the MCU. This wakes up the SuRG unit from Idle Mode, reads the SuRG demo board to determine the position of the dial and displays that value on the display. After 10 seconds of no input (touch or SuRG Demo Board interrupt), the SuRG unit quickly goes back to idle mode to conserve power. In the Status Bar, you will observe a clock increment when in Active mode, and text saying IDLE mode when in IDLE mode to help verify power modes, as the transition is seamless.

g)   Slideshow Demo

The Slideshow Demo highlights the SuRG42-CP's high-speed microSD interface and the LVGL graphics library. This demonstration shows the system's ability to efficiently retrieve and render images from the included microSDHC card, where a gallery of pre-loaded images illustrates the display's clarity and the SDHC card module's data handling capabilities. Since the Images take up the whole screen, to return from this demo, hold the Pushbutton PB2 for ~3 seconds, and press the menu button to return.

8. Software

SuRG software is built on the market leading FreeRTOS operating system. With a small memory footprint, fast execution times, and cutting-edge Real Time Operating System (RTOS) features and libraries including Symmetric Multiprocessing (SMP), a thread-safe TCP stack with IPv6 support, and seamless integration with cloud services. It's open-source and actively supported and maintained. Our starting point projects are all built in the easy-to-use STM32CubeIDE, ideally suited for Embedded Systems. The FDI provided demos show how to use:

- Processor and Platform Board Support Packages (BSPs)
- RTOS
- Memory Management
- QSPI Flash
- USB Device
- Micro SDCard Storage
- LCD Display
- Touch Screen
- Input / Output Devices

9. Board Layout

Figure 4 illustrates the layout of the various components of the SuRG42-CP Board Assembly. They are for reference only and are subject to change.
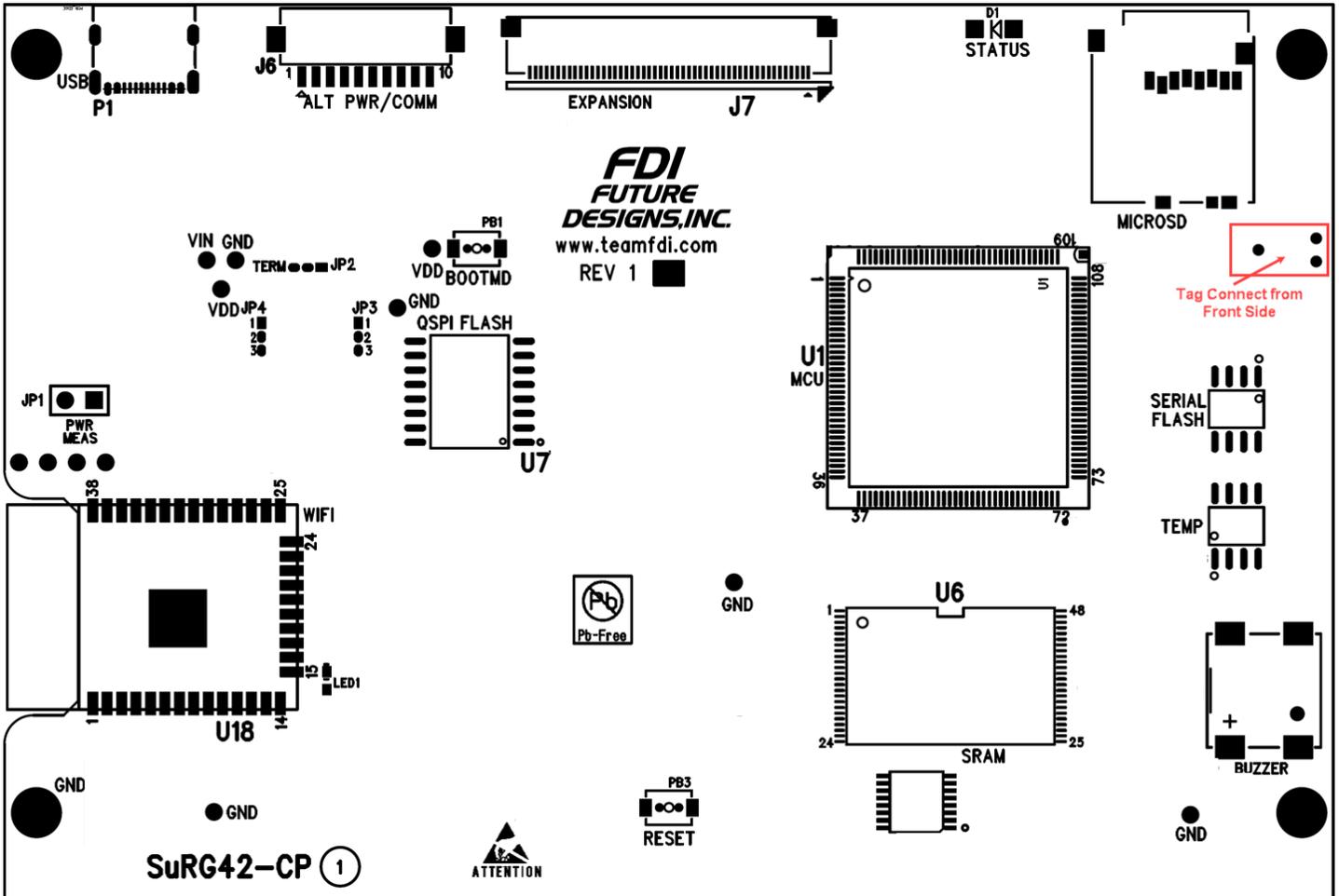

Figure 4 – SuRG42-CP Component View

10.   Display Performance

a) Display Architecture

The SuRG42-CP is a 4.2" sunlight-readable display specifically engineered for battery powered and energy sensitive applications. At its core, it utilizes reflective LCD technology, which allows the display to excel in outdoor environments by leveraging ambient sunlight to provide a crystal-clear image that becomes clearer in direct light.

Display Specifications

Resolution	400 x 300
Brightness (when front light is on)	~20 nits
Ambient Contrast Ratio (ACR)	17:1 (front light off), 15:1 (front light on)
Aspect Ratio	4 x 3
Colors:	3 (RWB) (2-bit)
Vertical Viewing Angle:	60/60° U/D
Horizontal Viewing Angle:	60/60° L/R
Surface Finish:	Anti-glare
Touchscreen type	Projected Capacitive

Because it does not require a constant, high-power backlight for visibility, the SuRG42-CP consumes 95% less power than typical transmissive TFT LCDs, maintaining a static image while drawing as little as 1.0 mA of current.

For use in low ambient lighting, the module also includes a PWM-controllable front light, ensuring full functionality in any lighting condition.

b) Display Advisory

While the SuRG42-CP is engineered for superior performance in direct sunlight environments, users may occasionally observe visual distortion of the LCD glass while in IDLE mode if high-intensity sunlight is allowed to enter directly through the **exposed sides**.

This phenomenon is caused by sunlight interacting with the sensors integrated into the edges of the display. This effect is rare and typically only occurs when the glass edges are perfectly aligned with the sun's rays. This distortion is entirely preventable by **ensuring the sides of the display are properly shielded** by the bezel or enclosure in the user's end product. If distortion is observed during testing, slightly adjusting the Display's orientation relative to the sun will immediately resolve the issue.

11. I/O Connector Descriptions

c) J1 - Tag Connect

SuRG features a 6-pin Tag-connect for programming and debugging the MCU, for use with the TC2030-ARM2010 ARM 20-pin to TC2030 Adapter. You must plug the 6-pin connector into the **top side of the board** (side with the display on it). Tag connect allows you to have a programming and debug connection on every board without paying for the connector.

Pin Number	Description	Pin Number	Description
1	VDD	4	SWCLK
2	SWDIO	5	GND
3	MCU_RST#	6	SWO

- Adapter: https://www.tag-connect.com/product/arm20-ctx-20-pin-to-tc2030-idc-adapter-for-cortex
- Cable with legs: https://www.tag-connect.com/product/tc2030-idc-6-pin-tag-connect-plug-of-nails-spring-pin-cable-with-legs
- Cable with no legs: https://www.tag-connect.com/product/tc2030-idc-nl
- Holding clip for no-legs cable version: https://www.tag-connect.com/product/tc2030-retaining-clip-board-3-pack
- J-Link Debug Probes: https://www.segger.com/products/debug-probes/j-link/ (Must support Cortex M-33)

If using development kit, please refer to the Tag Connect parts provided with the kit:
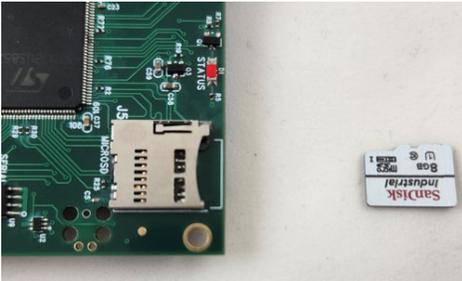https://fdiwebdocs.s3.us-east-2.amazonaws.com/2024/wp-content/uploads/SuRG42-CP-Quick-Start-Guide.pdf

Figure 5 – Tag-Connect JTAG adapter, cables, and pinout for 6-pin TC2030

d) J5 - MicroSD Socket

SuRG uses a MicroSD Socket for flexible mass storage capability. SuRG supports MicroSDHC and SDHC Cards up to 2TB. This interface uses 4-wire SD mode.

WARNING: The microSD card must only be removed using the spring loaded "push-pull" mechanism on the microSD socket. Improper forceful removal of the microSD card will result in permanent damage to the socket that is <u>not covered under warranty</u>. To insert the card, just push it into the socket until a "click" sound is heard.

Start with the microSD card in this position relative to the microSD slot with the text and "lip" facing up.	Next gently insert the card partially into the socket.
Use your finger to gently push the card into the socket until it clicks.	At this point the microSD card is fully inserted. It should not fall out.
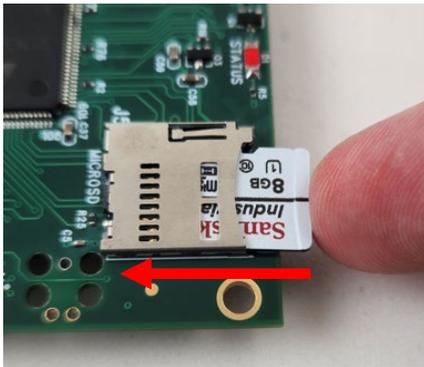
To remove the microSD card, press the card back into the socket until another "click" sound is heard, then release pressure on the card. At this point, the card should be partially ejected from the socket. Finally grab the card and gently pull to remove it. See the following pictures for proper micro-SD removal:

To remove the microSD card, gently push it into the socket again until it "clicks", and then release your figure.	At this point, the microSD card should partially stick out of the socket.
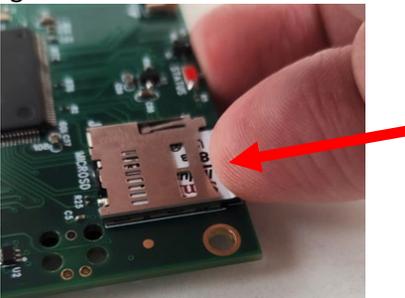
Carefully grab the edges or sides of the microSD card and gently pull it out.	At this point the microSD card is fully removed from the socket.
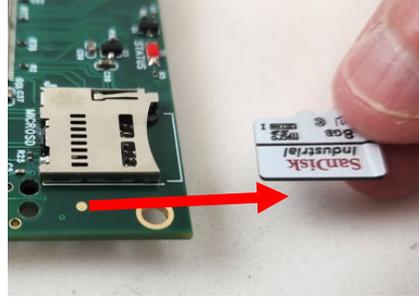
e) J6 - Alternate Power and comm Interface

The SuRG42-CP includes an alternate power and comm header. This header provides access to input power (VIN), circuitry power (VDD), SPI, UART, I2C, and CAN interfaces. This connector is a 1.25mm Hirose male, shrouded connector. The Hirose Part Number is: DF13A-10P-1.25H(20).

Pin Number	Description
1	SPI2_MOSI
2	SPI2_MISO
3	SPI2_SCK
4	VDD
5	VIN
6	GND
7	LRXD1/RS485B
8	LTXD1/RS485A
9	FDCAN1RX/T16_1/T4_3/I2C1_SCL
10	FDCAN1TX/SPI2_NSS/T4_4/T17_1/IR_OUT/I2C1_SCL

f) P1 – USB Type-C Power Input (5VDC, 3A)

The SuRG42-CP can be powered through a Type-C USB connector with the included 5V USB Wall Supply or via a standard powered USB port. This power supply is only included in the Development Kit, P/N SURG42-CP-DK.

Pin Number	Description	Pin Number	Description
A1	GND	B1	GND
A2	NC	B2	NC
A3	NC	B3	NC
A4	VIN	B4	VIN
A5	5.1K TO GND	B5	5.1K to GND
A6	D+	B6	D+
A7	D-	B7	D-
A8	NC	B8	VIN
A9	VIN	B9	VIN
A10	NC	B10	NC
A11	NC	B11	NC
A12	GND	B12	GND

g) J7 - Expansion Connector

The SuRG42-CP includes an expansion connector that provides a wide variety of capabilities for user expansion, ranging from CAN to USB Device, etc.

SUMMARY of EXPANSION CONNECTOR CAPABILLITES

Note: Many features are shared using the same pins. Always review the detailed pinout documentation to ensure all the features that you need can be provided simultaneously! If you are unsure how to verify this, reach out to Future Designs, Inc. at support@teamfdi.com and we will be happy to help you configure an I/O mapping that meets your requirements!

- USB Device OR USB Host (Not available if using on-board USB Device)
- Up to 1x RS485
- Up to 4x UARTs
- Up to 1x SPI
- Up to 2x I2C
- Up to 1x FDCAN
- Up to 4x Wake-Up pins
- Up to 5x Analog pins (up to 4x ADC In and up to 1x DAC out)
- Up to 15x Timers (summarize In/Out, PWM, Capture Compare, etc.)
- Up to 26x GPIO

DETAILS of EXPANSION CONNECTOR CAPABILLITES

Note: When using I/O signals on the Expansion Connector J7 to connect via the customers Expansion Board to external connectors or signals, it is the customer's responsibility to provide adequate ESD protection and filtering to prevent damage to any pins that are not directly protected on the SuRG.
The tables below provide the pinout and signal names available on these connectors:

J7 Signal Details

Pin	Pin Name	Pin Description	
1	GND		Power
2	PB6/TXD1/WKUP3/COMP2_2I2C1_SCL /I2C4_SCL/T4_CH4	Port B, Pin 6 - General purpose digital input/output pin	IO
		TXD1 - USART 1 Transmit Data	O
		WKUP3 - Wakeup Input 3	I
		COMP2_2I2C1_SCL - Comparator 2 Channel 2 for I2C Instance 1 / and I2C1 Serial Clock	I / IO
		I2C4_SCL - I2C Instance 4 Serial Clock	IO
		T4_CH4 - Timer 4 Channel 4	IO
3	PB7/RXD1/CTS4/WAKE4_7/I2C1_SDA/I 2C4_SDA/T4_CH2	PB7 - General purpose digital Input/Output pin	IO
		RXD1 - USART 1 Receive Data	I
		CTS4 - USART 4 Clear-To-Send	I
		WAKE4_7 - Wakeup Input 7	I
		I2C1_SDA - I2C Instance 1 Serial Data	IO
		I2C4_SDA - I2C Instance 4 Serial Data	IO
		T4_CH2 - Timer 4 Channel 2	IO
4	N/A	N/A	N/A
5	PG10/RXD1/LT1_1	PG10 - Port G Pin 10 general purpose digital Input/Output pin	IO

Pin	Pin Name	Pin Description	
		RXD1 - USART 1 Receive Data	I
		LT1_1 - Low-Power Timer 1, channel 1	IO
6	PB1/LRTS1/RTS3/T1_3N/T3_4/LT3_2	PB1 - Port B Pin 1 general purpose digital input/output pin	IO
		LRTS1 - Low-power UART 1 Request To Send	O
		RTS3 - USART3 Request To Send	O
		T1_3N - Timer 1 Channel 3	O
		T3_4 - Timer 3 Channel 4	IO
		LT3_2 - Low-Power Timer 3 Channel 2	IO
7	PB13/LCTS1/CTS3/T1_1N/LT3_1/I2C2_SCL/SPI2_SCK	PB13 - General purpose digital input/output pin	IO
		LCTS1 - Low-Power Clear-To-Send	I
		CTS3 - USART 3 Clear-To-Send	I
		T1_1N - Timer 1 Channel 1	O
		LT3_1 - Low-Power Timer 3 Channel 1	IO
		I2C2_SCL - I2C Instance 2 Serial Clock	IO
		SPI2_SCK - SPI Instance 2 Serial Clock	I (MCU is SPI Slave) O (MCU is SPI Master)
8	PB10/LRXD1/TXD3/T2_3/LT3_1/I2C4_SCL/I2C2_SCL/SPI2_SCK	PB10 - Port B Pin 10 general purpose digital input/output pin	IO
		LRXD1 - Low-Power USART 1 Receive Data	I
		TXD3 - USART 3 Transmit Data	O
		T2_3 - Timer 2 Channel 3	IO
		LT3_1 - Low-Power Timer 3 Channel 1	IO
		I2C4_SCL - I2C Instance 4 Serial Clock	IO
		I2C2_SCL - I2C Instance 2 Serial Clock	IO
		SPI2_SCK - SPI Instance 2 Serial Clock	I (MCU is SPI Slave)/O (MCU is SPI Master)
9	PB11/LTXD1/RXD3/T2_4/I2C4_SDA/I2C2_SDA/SPI2_RDY	PB11 - Port B Pin 11 general purpose digital input/output pin	IO
		LTXD1 - Low-Power USART 1 Transmit Data	O
		RXD3 - USART 3 Receive Data	I
		T2_4 - Timer 2 Channel 4	IO
		I2C4_SDA - I2C Instance 4 Serial Data	IO
		I2C2_SDA - I2C Instance 2 Serial Clock	IO
		SPI2_RDY - SPU Instance 2 Slave-Ready Signal	O
10	GND		Power
11	N/A	N/A	N/A
12	PA10_USB_ID	PA10_USB_ID - Detects if device is host or peripheral via resistance	I
13	PA9_USB_VBUS	PA9_USB_VBUS - Monitors the presence of USB bus power. Note: This signal must be HIGH for USB reset to occur.	I
14	PG12_VBUS_OVR#	PG12_VBUS_OVR# - P ort G Pin 12 Active-low signal from power switch indicating overcurrent	I
15	PG13_VBUS_EN#	PG13_VBUS_EN# - P ort G Pin 13 active-low control to enable USB host power	O
16	PB15/WKUP7/T1_3/LT2_2/T8_3N/SPI2_MOSI	PB15 - Port B Pin 15 general purpose digital input/output pin	IO
		WKUP7 - Wakeup Input 7 (I)	I
		T1_3 - Timer 1 Channel 3	IO
		LT2_2 - Low-Power Timer 2 Channel 2	IO
		T8_3N - Timer 8 Channel 8	O
		SPI2_MOSI - SPI2 Master Out Slave In	O (MCU is SPI master) / I (MCU is SPI slave)
17	PC2/ADC1_3/ADC4_3/LT1_2/SPI2_MISO	PC2 - Port C Pin 2 general purpose digital input/output pin	IO
		ADC1_3 - ADC 1 Channel 3 voltage measurement	I
		ADC4_3 - ADC 4 Channel 3 voltage measurement	I
		LT1_2 - Low-Power Timer 1 Channel 2	IO
		SPI2_MISO - SPI2 Master In Slave Out	I (MCU is SPI master) / O (MCU is SPI slave)
18	PD3/CTS2/SPI2_SCK/SPI2_MISO	PD3 - Port D Pin 3 general purpose digital input/output pin	IO

Pin	Pin Name	Pin Description	
		CTS2 - USART 2 Clear-To-Send	I
		SPI2_SCK - SPI Instance 2 Serial Clock	I (MCU is SPI Slave) / O (MCU is SPI Master)
		SPI2_MISO - SPI2 Master In Slave Out	I (MCU is master) / O (MCU is slave)
19	LRXD1/RS485B	LRXD1 - Low-Power USART 1 Receive Data	I
		RS485B - LPUART1 Receive Data B	I
20	LTXD1/RS485A	LTXD1 - Low-Power USART 1 Transmit Data	O
		RS485A - RS485B - LPUART1 Receive Data A	I
21	POWER_BTN#		I
22	GND		Power
23	RESET_INn		I
24	RESET_OUTn		O
25	PA4/DAC1_1/ADC1_9/ADC4_9	PA4 - Port A Pin 4 general purpose digital input/output pin	IO
		DAC1_1 - DAC1 Channel 1 analog voltage measurement	O
		ADC1_9 - ADC 1 Channel 9 voltage measurement	I
		ADC4_9 - ADC 4 Channel 9 voltage measurement	I
26	PA3/LRXD1/RXD2/ADC1_8/WKUP5/T2_4/T5_4	PA3 - Port A Pin 3 general purpose digital input/output pin	IO
		LRXD1 - Low-Power USART 1 Receive Data	I
		RXD2 - USART 2 Receive Data	I
		ADC1_8 - ADC 1 Channel 8 voltage measurement	I
		WKUP5 - Wakeup Input 5	I
		T2_4 - Timer 2 Channel 4	IO
		T5_4 - Timer 5 Channel 4	IO
27	PB9/FDCAN1_TX/T4_4/T17_1/IR_OUT/I2C1_SDA/SPI2_NSS	PB9 - Port B Pin 9 general purpose digital input/output pin	IO
		FDCAN1_TX - CAN FD Channel 1 Transmit	O
		T4_4 - Timer 4 Channel 4	IO
		T17_1 - Timer 17 Channel 1	IO
		IR_OUT - Infrared Output	O
		I2C1_SDA - I2C Instance 1 Serial Data	IO
		SPI2_NSS - SPI instance 2 Chip Select/Slave Select	O (MCU is SPI master)/ I (MCU is SPI slave)
28	PB8/FDCAN1_RX/T16_CH1/T4_CH3/I2C1_SCL	PB8 - Port B Pin 8 general purpose digital input/output pin	IO
		FDCAN1_RX - CAN FD Channel 1 Receive	I
		T16_CH1 - Timer 16 Channel 1	IO
		T4_CH3 - Timer 4 Channel 3	IO
		I2C1_SCL - I2C Instance 1 Serial Clock	IO
29	GND		Power
30	PG15/LT1_1/I2C1_SMBA	PG15 - Port G Pin 15 general purpose digital input/output pin	IO
		LT1_1 - Low-Power Timer 1 Channel 1	IO
		I2C1_SMBA - I2C Instance 1 SMBus Alert	IO
31	PG14/LT1_2/I2C1_SCL	PG14 - Port G Pin 14 general purpose digital input/output pin	UI
		LT1_2 - Low-Power Timer 1 Channel 2	UI
		I2C1_SCL - I2C Instance 1 Serial Clock	UI
32	VDD	2.8V	Power
33	PD6/RXD2	PD6 - Port D Pin 6 general purpose digital input/output pin	IO
		RXD2 - USART 2 Receive Data	I
34	G6/LRTS1/SPI1_RDY	G6 - Port G Pin 6 general purpose digital input/output pin	IO
		LRTS1 - Low-power UART 1 Request To Send	O
		SPI1_RDY - SPI Instance 1 Ready signal	I
35	N/A	N/A	N/A
36	PF11_LT4_I1	PF11_LT4_I1 - LPTIM4 Input 1	I
37	N/A	N/A	N/A
38		PB0 - Port B Pin 0 general purpose digital input/output pin	IO

Pin	Pin Name	Pin Description	
	PB0/ADC1_15/ADC4_18/T1_2N/T3_3/T8_2N/LT3_1/SPI1_NSS	ADC1_15 - ADC 1 Channel 15 voltage measurement	I
		ADC4_18 - ADC 4 Channel 18 voltage measurement	I
		T1_2N - Timer 1 Channel 2	O
		T3_3 - Timer 3 Channel 3	IO
		T8_2N - Timer 8 Channel 2	O
		LT3_1 - Low-Power Timer 3 Channel 1	IO
		SPI1_NSS - SPI instance 1 Chip Select/Slave Select	O (MCU is SPI master) / I (MCU is SPI slave)
39	GND		Power
40	N/A	N/A	N/A
41	A1/RXD4/RTS2/ADC1_6/LT1_2/T2_2/T5_2/I2C1_SMBA/SPI1_SCK	A1 - Port A Pin 1 general purpose digital input/output pin	IO
		RXD4 - USART 4 Receive Data	I
		RTS2 - USART 2 Request-To-Send	I
		ADC1_6 - ADC 1 Channel 6 voltage measurement	I
		LT1_2 - Low-Power Timer 1 Channel 2	IO
		T2_2 - Timer 2 Channel 2	IO
		T5_2 - Timer 5 Channel 2	IO
		I2C1_SMBA - I2C Instance 1 SMBus Alert	IO
		SPI1_SCK - SPI1 Serial Clock	O (MCU is SPI master)/ I (MCU is SPI slave)
42	PA0/TXD4/CTS2/T2_1/T5_1/SPI3_RDY	PA0 - Port A Pin 0 general purpose digital input/output pin	IO
		TXD4 - USART 4 Transmit Data	O
		CTS2 - USART 2 Clear-To-Send	I
		T2_1 - Timer 2 Channel 1	IO
		T5_1 - Timer 5 Channel 1	IO
		SPI3_RDY - SPI Instance 3 Ready signal	I
43	USBD_DP	USBD _DP - USB Data Plus	IO
44	USBD_DM	USBD_DM - USB Data Minus	IO
45	USBD_VBUS	USBD_VBUS - Monitors the presence of USB bus power Note: This signal must be HIGH for USB reset to occur	I
46	VIN	3-24V	Power
47	VIN	3-24V	Power
48	VBATTIN	2.8-24V	Power
49	VDD	2.8V	Power
50	VDD	2.8V	Power

Expansion Connector Cable Details

The maximum length for the expansion connector cables is as follows:

General Purpose IO, TTL, Serial, etc. = 6" recommended maximum, 8" absolute maximum

Ethernet, high-speed IO, etc. = 3" recommended maximum, 4" absolute maximum

The following table provides example part numbers for the expansion cables:

Description	Mfg.	Mfg. PN	Digi-Key Pn
3" 50-pin 0.5mm	Molex	21020-7650	WM10231-ND
6" 50-pin 0.5mm	Molex	21020-0548	WM10223-ND

Note: These lengths are only recommendations. The actual lengths utilized depend on the expansion board circuitry, layouts and general environment of the application. Tests and validation should be conducted to ensure the functional operation and use of all third-party expansion connectors.

12.   Temperature Range

Operating: -20°C to +70°C

Storage: -30°C to +80°C

13.   ESD Warning

The SuRG42-CP Board Assembly is shipped in a protective anti-static bag inside a shipping box. The board assembly must not be subjected to high electrostatic potentials. Damage may occur to the board that will not be covered under warranty. General practice for working with static sensitive devices should be followed when working with the board.

14.   Power Requirements

Power (VIN) can be supplied to a SURG42-CP assembly using one of three different interfaces:

1. USB-C Connector (P1)
2. Alternate Power & Comm Interface (J6)
3. Expansion Connector (J7)

The power supply included in the Dev Kit provides 5VDC output at 1.2A (min) and has input voltage range of 100-240VAC with standard U.S. 2-prong plug. The following typical power requirements were measured at room temperature with the SuRG42-CP in ACTIVE mode while touching the screen:

Voltage	Observed Max Current (Frontlight OFF)	Observed Max Current (Frontlight ON)
2.7V	31.65 mA	77.54 mA
3.0V	27.77 mA	67.45 mA
5.0V	17.35 mA	39.39 mA
24.0V	5.48 mA	11.77 mA

SuRG Power Input Requirements:
- 3.0 - 24VDC is the input voltage range with a tolerance of + or – 3%.

- The SuRG42-CP can provide a maximum of 550mA at 2.7V on the expansion connector or the Alternate Power and Comms Interface. If more than 550mA at 2.7V V is needed on the expansion board then put a power system on the expansion board and keep it isolated from SuRG VIN.

15.   Mechanical Details

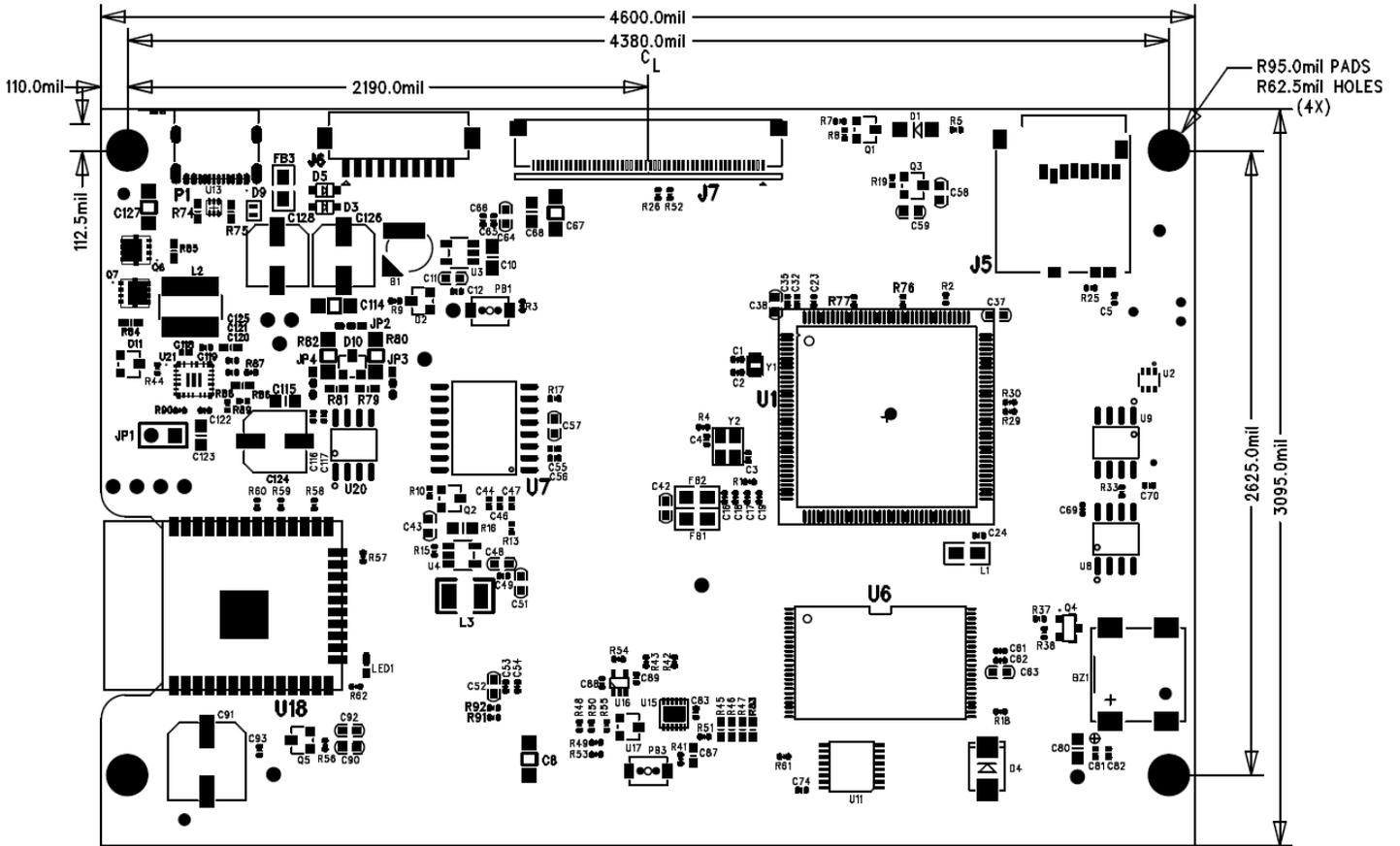Figure 6 shows the mechanical details of the SuRG42-CP PCB.

Figure 6 – Mechanical Dimensions (Component View)

16.   Additional Notes

1. PWM Front Light
   a. The RCC register "APB1SMENR2" must have its bit 5 LPTIM2SMEN set to 1 to enable Low-Power Timer 2 clock gating before entering idle mode, else when the front light is enabled after returning to Active mode flickering issues might occur.

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