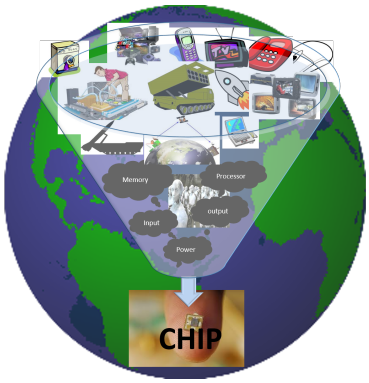

VLSI System Design (VSD)

VSDSquadron Mini

The VSDSquadron Mini board, blending RISC-V ISA innovation with education, offers a developmental playground for exploring advanced computing concepts

Contents

List of Tables

List of Figures

1 Getting Started

The VSDSquadron Mini RISC-V development board - Features and Interfaces:

- Core Processor - The board is powered by CH32V003F4U6 chip with 32-bit RISC-V core based on RV32EC instruction set, optimized for high-performance computing with support for 2-level interrupt nesting and supports 24MHz system main frequency in the product function
- Clock and Reset Systems: Includes a built-in factory-trimmed 24MHz RC oscillator and a 128kHz RC oscillator, plus an external 24MHz oscillator option for varied clocking requirements
- Robust GPIO Support: Boasts 3 groups of GPIO ports, totaling 15 I/O ports, enabling extensive peripheral connections and mapping to external interrupt capabilities
- Flexible Communication Interfaces: Offers multiple communication protocols including USART, I2C, and SPI for versatile connectivity options
- High-Speed Memory: Equipped with 2KB SRAM for volatile data storage, 16KB CodeFlash for program memory, and additional 1920B for bootloader functionalities
- **On-board Programmer: Features on-board CH32V305FBP6 single-wire programming protocol, enhancing development efficiency with seamless code deployment and debugging. NO NEED to purchase any additional adapter**

The VSDSquadron Mini RISC-V SoC device available on the development board is programmed using the on-board flash programmer which supports the CH32V305FBP6 single-wire programming protocol, enabling streamlined and efficient development workflows directly on the board. Connect the VSDSquadron Mini board using a USB C connector to program the CH32V003F4U6 chip.

1.1 Kit Contents

The following table lists the contents of the VSDSquadron Mini RISC-V development board.

Item	Quantity
VSDSquadron Mini RISC-V development board featuring the 32-bit RISC-V core based on RV32EC instruction set	1

Table 1: Kit Contents

1.2 Block Diagram

The following block diagram shows the key components of the VSDSquadron Mini RISC-V development board.

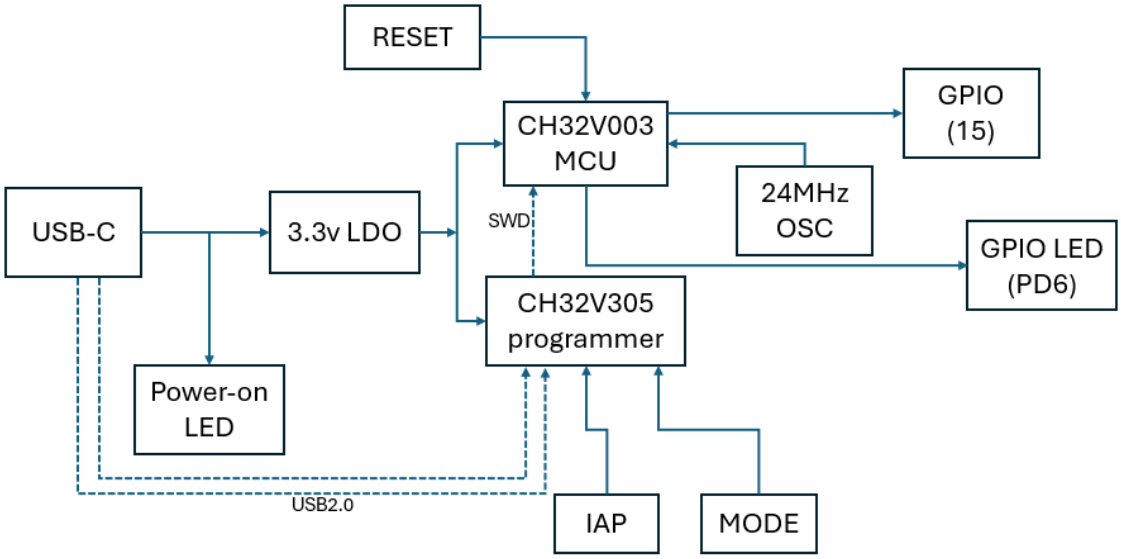

Figure 1: VSDSquadron Mini RISC-V development board Block Diagram

1.3 Web Resources

For more information about the VSDSquadron Mini RISC-V SoC device, refer to CH32V003F4U6 RISC-V SoC Datasheet and CH32V003F4U6 RISC-V SoC Reference Manual

1.4 Board Overview

The VSDSquadron Mini RISC-V development boards features a RISC-V SoC with the following capabilities:

- On-board 24MHz RC oscillator
- 3 groups of GPIO ports, totaling 15 I/O ports
- USART, I2C, and SPI
- UART implemented on USART
- 2KB SRAM for volatile data storage, 16KB CodeFlash for program memory
- On-board Programmer. NO NEED of any additional adapter

The following illustration highlights various components of the VSDSquadron Mini RISC-V development board.

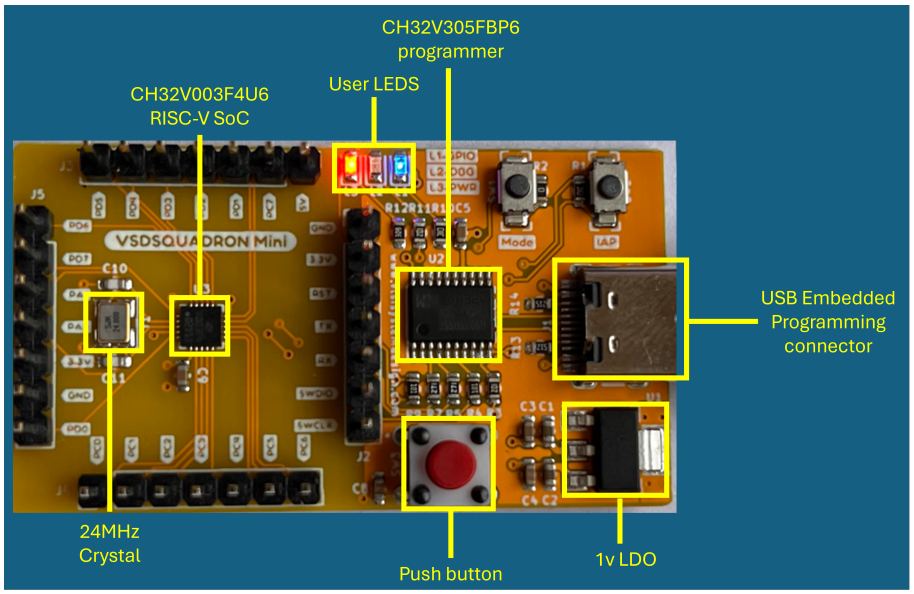

Figure 2: VSDSquadron Mini RISC-V development board Board image

1.4.1 Form Factor

The following are the dimensions of the VSDSquadron Mini RISC-V development board.

- Form factor is 50.00 x 28.00 mm
- Maximum height of the component at the top side: 8mm
- Maximum height of the component at the bottom side: 1mm

1.4.2 Table 2 shows CH32V003F4U6 RISC-V SoC IO Bank Assignment for communication Interfaces

Interface	Caravel Bank Allocation
SPI	PC5(SCK), PC1(NSS), PC6(MOSI), PC7(MISO)
I2C	PC1(SDA), PC2(SCL)
USART	PD6(RX), PD5(TX)

Table 2: CH32V003F4U6 RISC-V SoC IO Bank Assignment

1.4.3 The following table 3 lists the important components of the VSDSquadron Mini RISC-V development board

Board	VSDSquadron Mini
Microcontroller	CH32V003F4U6 chip with 32-bit RISC-V core based on RV32EC instruction set
USB connector	USB 2.0 Type-C
Built-in LED Pin	1x onboard user led (PD6)
Digital I/O pins	15x
Analog I/O pins	10-bit ADC, PD0-PD7, PA1, PA2, PC4
PWM pins	14x
External interrupts	8 external interrupt edge detectors, mapped to any one of 18 external I/O ports
USART	1x, PD6(RX), PD5(TX)
I2C	1x, PC1(SDA), PC2(SCL)
SPI	1x, PC5(SCK), PC1(NSS), PC6(MOSI), PC7(MISO)
Programmer/debugger	Onboard RISC-V programmer/debugger, USB to TTL serial port support
I/O voltage	3.3V
Input voltage (nominal)	5V
Source Current per I/O Pin	8mA
Sink Current per I/O Pin	8mA
Clock speed	Processor: 24MHz
Memory	SRAM: 2kb on-chip volatile sram, 16kb external program memory

Table 3: Specifications of the VSDSquadron Mini Board

1.5 Handling the Board

To avoid causing any damage or malfunctions, it is important to be mindful of the following points when handling or operating the board:

- To prevent any damage, make sure to handle the board while taking electrostatic discharge (ESD) precautions.
- Power down the board by disconnecting the board from USB port

1.6 Operating Temperature

Designed for Room Temperature. The standard range for room temperature in Celsius is typically considered to be between 20 to 35 degrees Celsius (or 68 to 95 degrees Fahrenheit).

1.7 Powering Up the Board

Connect the Type-C end of USB cable to the board as shown in below image and refer to Installation and Settings for programming the board

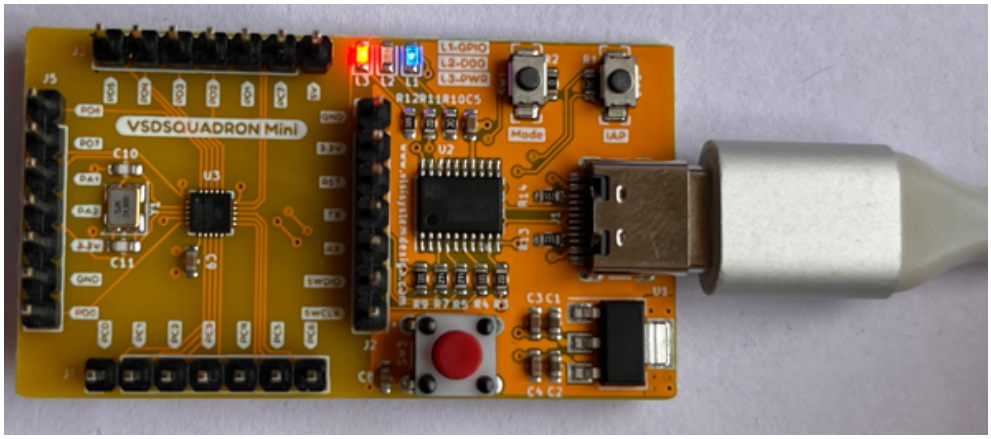

Figure 3: Micro-C end of USB cable connected to board

2 Installation and Settings

This section provides information about the software and hardware settings required to run blink_test on the VSDSquadron Mini RISC-V development board using PlatformIO

2.1 Install VSCode

- Download and install VSCode from https://code.visualstudio.com.

2.2 Install PlatformIO

- Open the "Extensions" sidebar in VSCode, as shown in Figure 4.
- Search for "PlatformIO" and click "install", as shown in Figure 4.

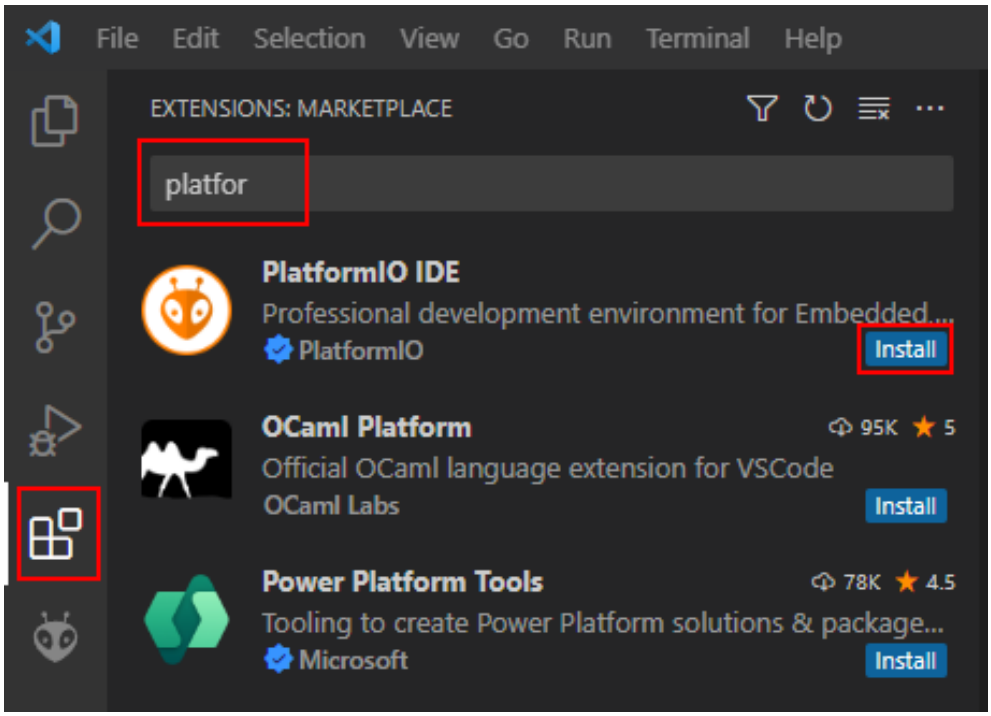

Figure 4: VSCode GUI highlighting "Extension" and "PlatformIO IDE"

2.3 Install CH32V Platform

- Expand the PlatformIO sidebar (ant icon) and click "PIO Home" as shown in Figure 5.
- In the PIO Home window, click on the "Platforms" sidebar and choose "Advanced Installation" as shown in Figure 6.
- Enter the following repository URL when prompted and press "Install," as shown in Figure 7: https://github.com/vsdip/vsdsquadron_pio

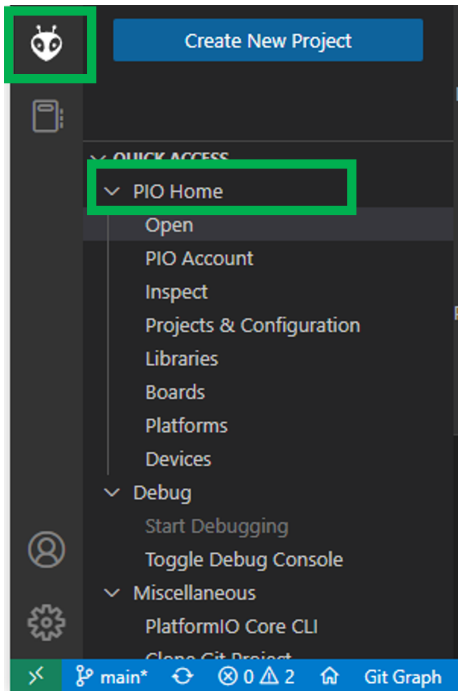

Figure 5: VSCode GUI highlighting "ant icon" and "PIO Home"

2.4 Install WCH-Link driver

- Go to the link https://github.com/Community-PIO-CH32V/wchlink-driver-windows
- Click on the "Download Zip" buttom as shown in below Figure 8
- Download this driver and unzip it
- Go to your device manager and locate the unknown driver, right click on it and select update driver
- Select 'browse my computer for drivers', select the unzipped folder and install it

2.5 Uploading blink example

- Click on "Platforms" as shown in Figure 9
- Click on "VSDSquadron" as shown in Figure 9
- Click on "Examples" as shown in Figure 10
- Click on "Import" as shown in Figure 10
- You should see "vsdsquadronmini" under "Project Tasks" as shown in Figure 11
- Click on "Build" and "Upload" button as shown in Figure 11

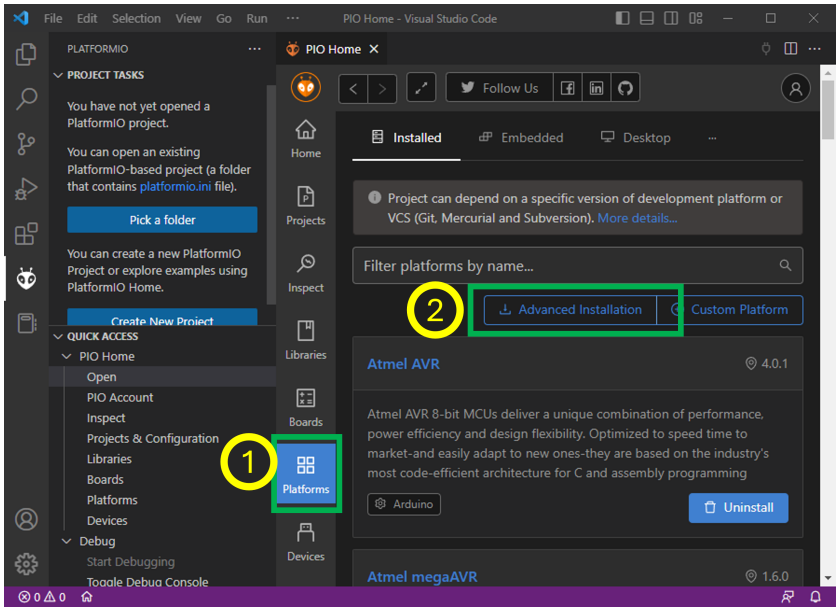

Figure 6: VSCode GUI highlighting "Platforms" sidebar and "Advanced Installation"

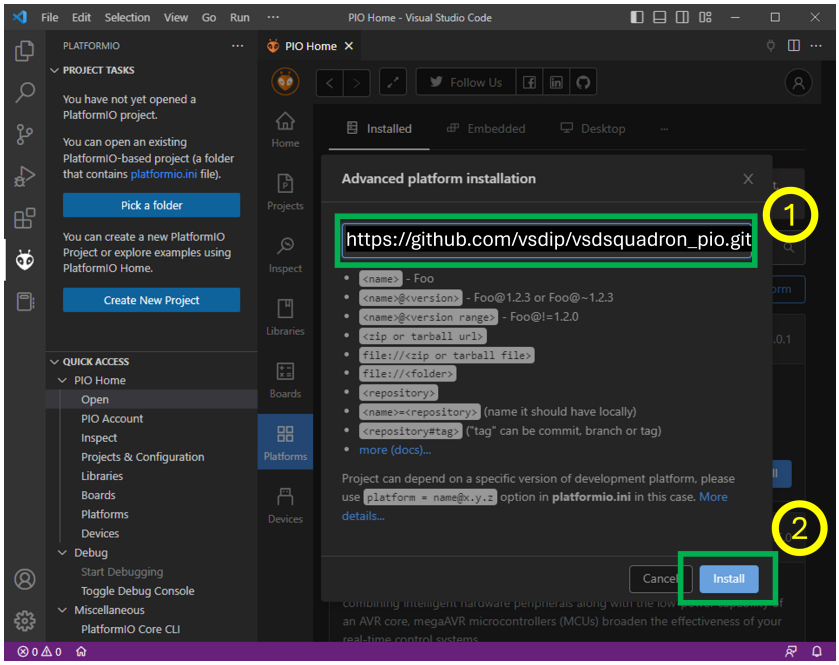

Figure 7: VSCode GUI highlighting "Repository URL" and "Install" button

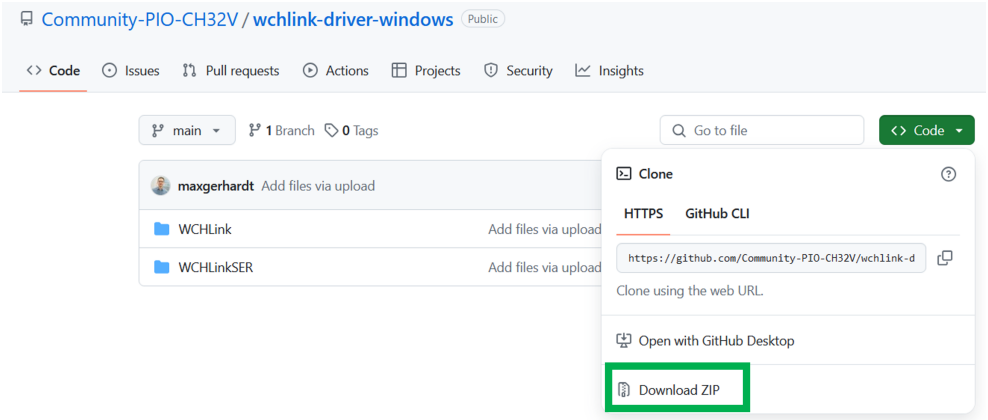

Figure 8: WCHLink Driver Windows

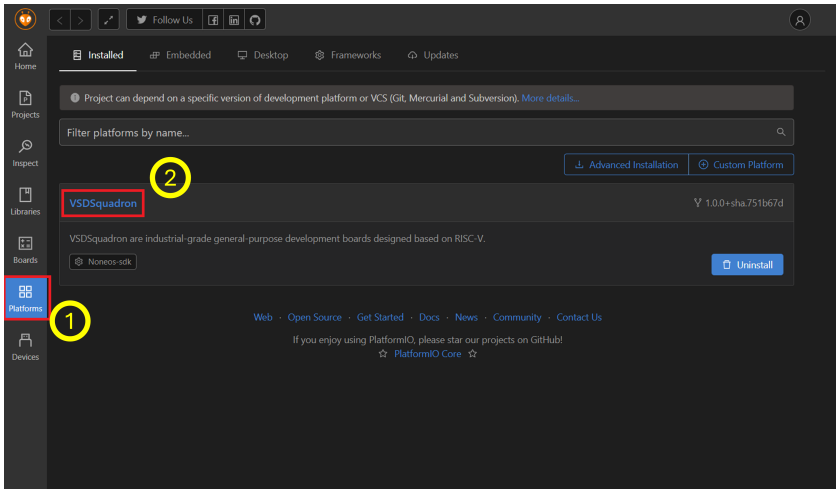

Figure 9: VSCode GUI highlighting "Platforms" and "VSDSquadron" platform which you sucessfully installed in previous step

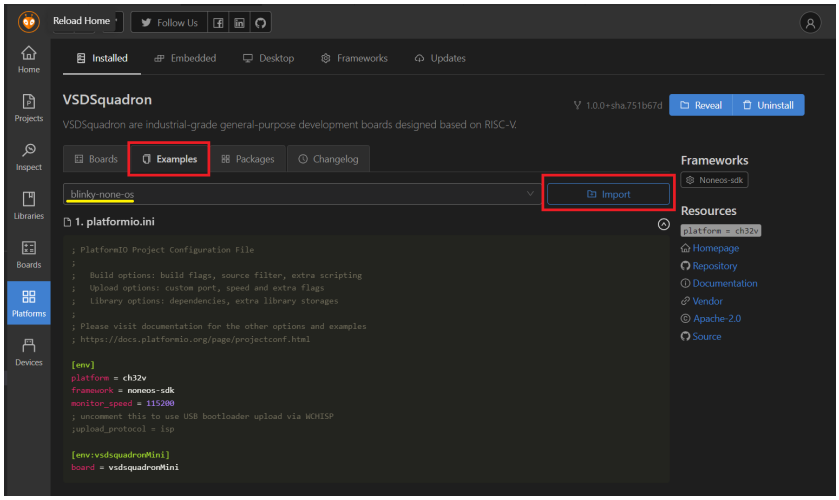

Figure 10: VSCode GUI highlighting "Examples" and "Import" buttons

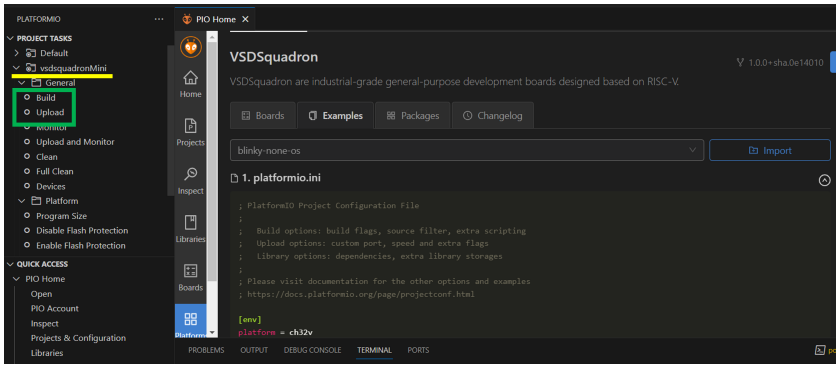

Figure 11: VSCode GUI highlighting "vsdsquadronmini" under "PROJECT TASKS" and "Build" "Upload" buttons

3 Board Component Placement

The following figure shows the placement of various components on the VSDSquadron Mini RISC-V development board.

3.1 VSDSquadron Mini top view

The following Figure 12 shows the top view of the VSDSquadron Mini RISC-V development board.

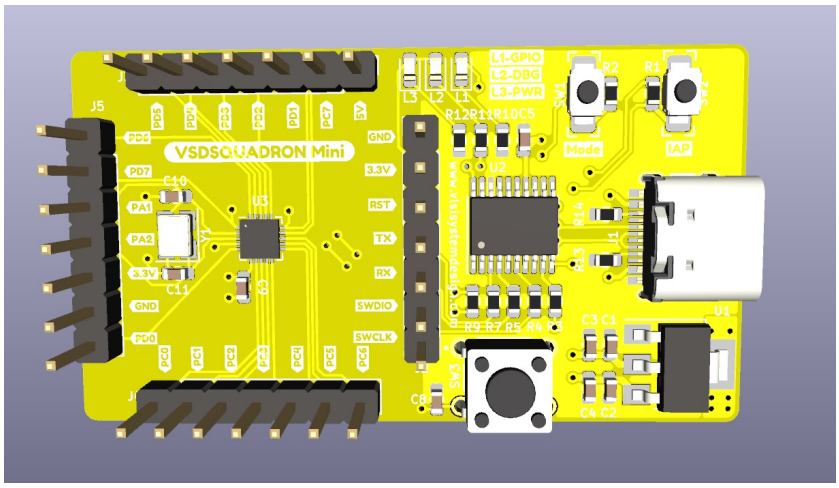

Figure 12: Silkscreen Top View

3.2 VSDSquadron Mini bottom view

The following Figure 13 shows the bottom view of the VSDSquadron Mini RISC-V development board silkscreen.

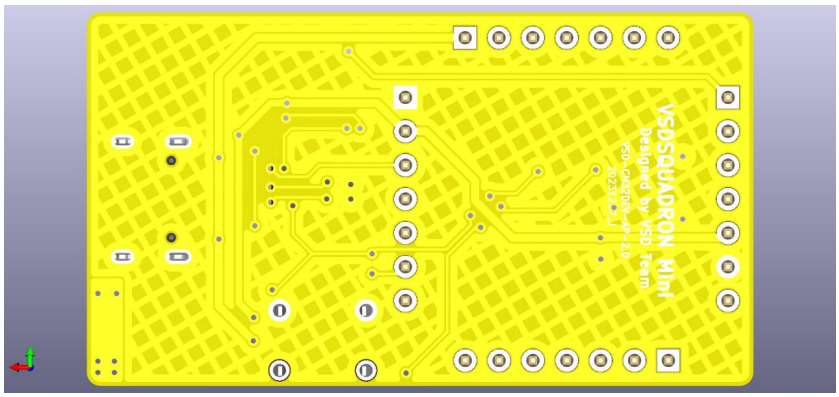

Figure 13: Silkscreen Top View

4 Revision History

The document's revision history provides a record of the alterations made to it, listed in chronological order, with the most recent revision first.

Revision	Date	Description
1.0	-	This is the first publication of this document

Table 4: Revision History

5 Help and support

- Contact email ID - vsd@vlsisystemdesign.com
- Online Slack support - https://vsdsquadron.slack.com/