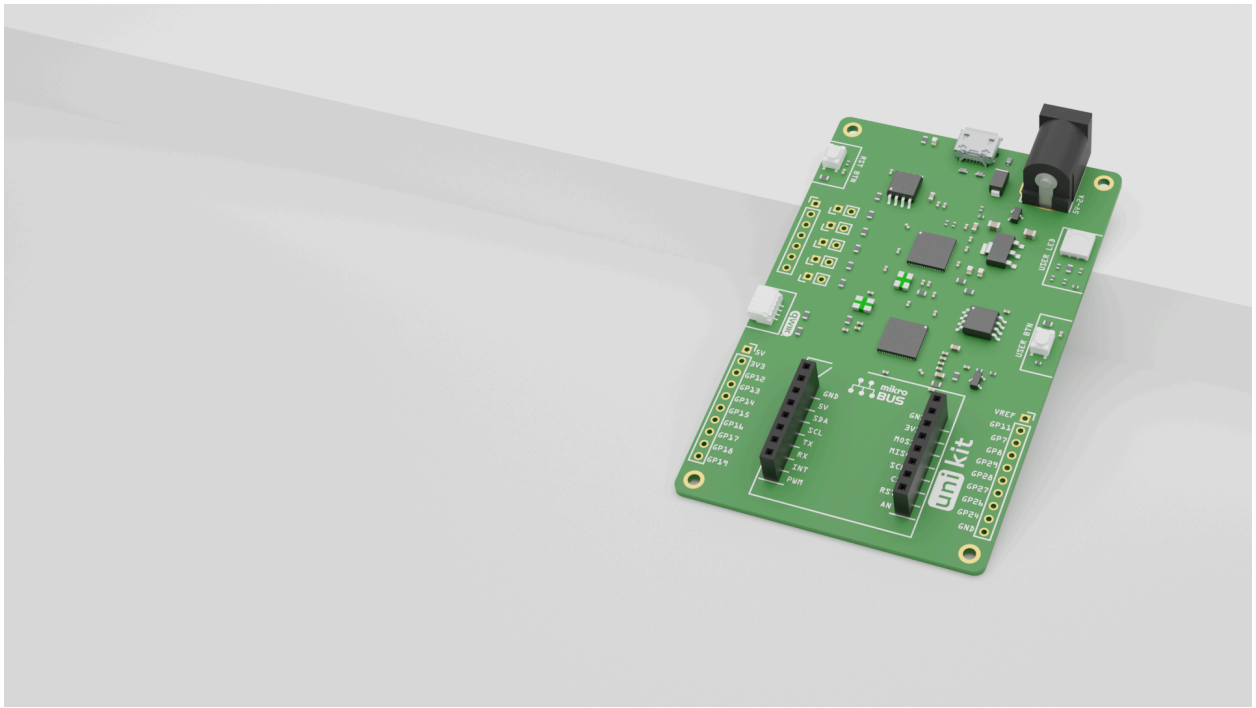
UG001: Uni-Kit Micro Plus User Guide

The Uni-Kit Micro Plus is a low-cost, credit card form factor development and evaluation platform for getting started with microcontrollers.

The Uni-Kit is focused on rapid prototyping and concept creation for mainly embedded and IoT applications. It is designed around the RP2040 SoC, an ideal device for developing beginner embedded applications.

The Uni-Kit features a USB interface, an onboard debugger, one user-LED, one user button, and support for hardware add-on boards via a mikroBus socket and a Qwiic connector. The hardware add-on support allows developers to create and prototype applications using virtually endless combinations of off-the-shelf boards from mikroE, SparkFun, AdaFruit, and Seeed Studios.



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1. Introduction

1.1 Kit Contents

The following items are included in the box

- 1x Uni-Kit Micro Plus Board (UKMP001D)
- 1x USB Cable
- 1x Pin Map Sheet

1.2 Getting Started

Detailed instructions for how to get started with Uni-Kit Micro Plus can be found on the Uni-Kit web page: https://www.uni-kit.in

1.3 Hardware Content

The following key hardware elements are included in the Uni-Kit Micro Plus:

- RP2040 SoC with 133MHz 32bit Dual Core Arm® Cortex®-M0+, 2 MB of Flash and 264 kB of SRAM.
- One RGB LED and one button.
- On-board debugger for easy programming and debugging, which includes a USB virtual COM port.
- MikroBUS socket for connecting MIKROE Click boards™ and other mikroBUS add-on boards.
- Qwiic connector for connecting Qwiic Connect System hardware.
- Breakout pads for GPIO access and connection to external hardware.
- Reset button.

1.4 Kit Hardware Layout

Uni-Kit Micro Plus layout is shown below.

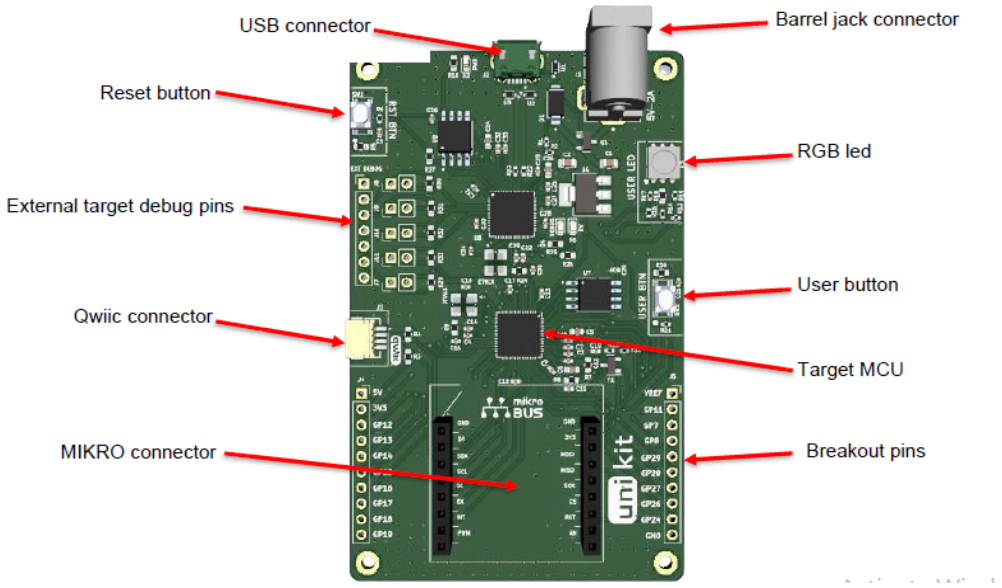

Figure 1.1: Kit hardware layout

2. Specifications

2.1 Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
USB Supply Input Voltage	V_{USB}	-	+5.0	-	V
Supply Input Voltage (VMCU supplied externally)	V_{MCU}	-	+3.3	-	V
Operating Temperature	T_{OP}	-	+20	-	˚C

3. Hardware

The core of the Uni-Kit Micro Plus is the RP2040 System-on-Chip.

3.1 Block Diagram

An overview of the Uni-Kit Micro Plus is illustrated in the figure below.

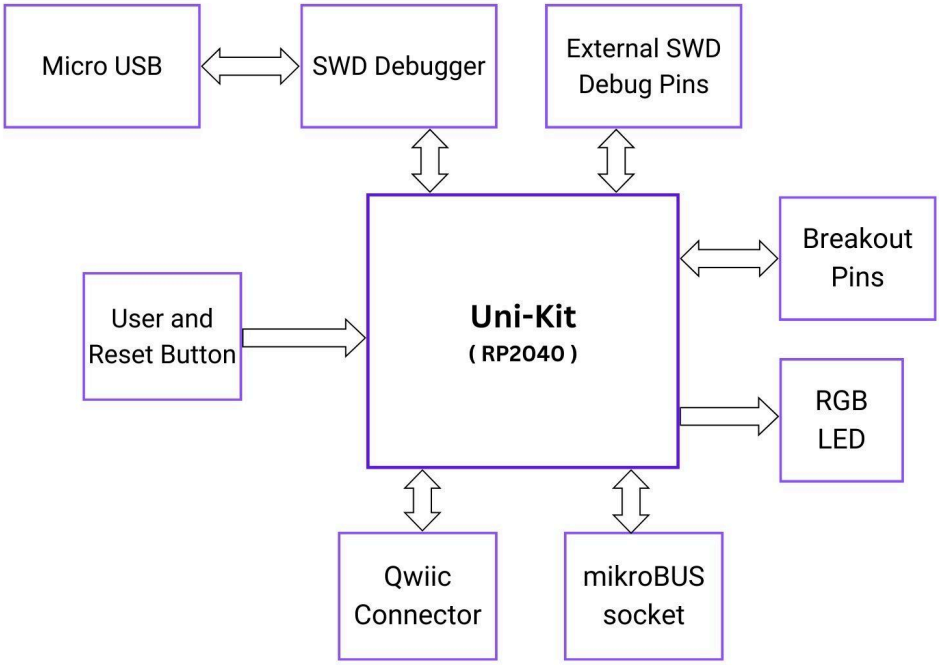

Figure 3.1: Kit Block Diagram

3.2 Power Supply

The kit is powered by the debug USB cable as illustrated in the figure below.

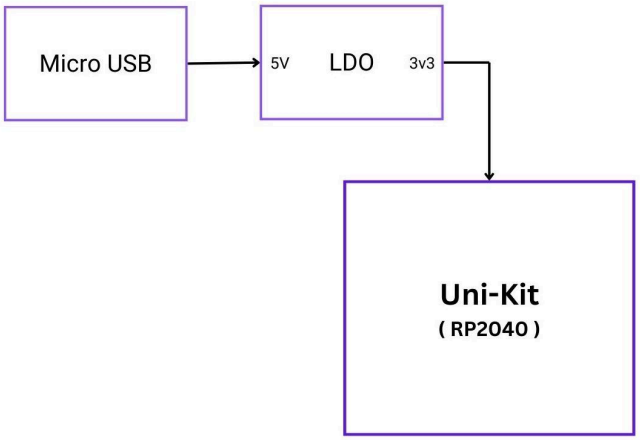

Figure 3.2: Uni-Kit Power Topology

The 5 V power net on the USB bus is regulated down to 3.3 V using a low-dropout regulator (LDO).

Power can be injected externally on the V_{MCU} net if the USB cable is removed and no other power sources are present on the kit. Failure to follow this guideline can cause power conflicts and damage the LDO.

3.3 Reset

The target RP2040 can be reset by a few different sources as below,

- A user presses the RESET button.
- The on-board debugger pulling the RESET pin low.

3.4 User Button and LED

The kit has one user push-button marked USER BTN that is connected to the GPIO on the RP2040. The button is connected to pin GP25 and they are debounced by an RC filter. The logic state of a button is high while that button is not being pressed, and low when it is pressed.
The kit also features RGB LED marked as USER LED controlled by GPIO pins on the RP2040. The LEDs are connected to pins GP03, GP04 and GP05 respectively, in an active-high configuration.

Figure 3.3: User Buttons and LED

3.5 On-Board Debugger

The Uni-Kit Micro Plus contains a microcontroller separate from the RP2040 Wireless Gecko that provides the user with an onboard debugger through the USB Type-B port. This microcontroller is referred to as the "on-board debugger", and is not programmable by the user.

In addition to providing code download and debug features, the on-board debugger also presents a virtual COM port for general-purpose application serial data transfer.

The figure below shows the connections between the target RP2040 device and the on-board debugger. Refer to section 4. Debugging for more details on debugging.

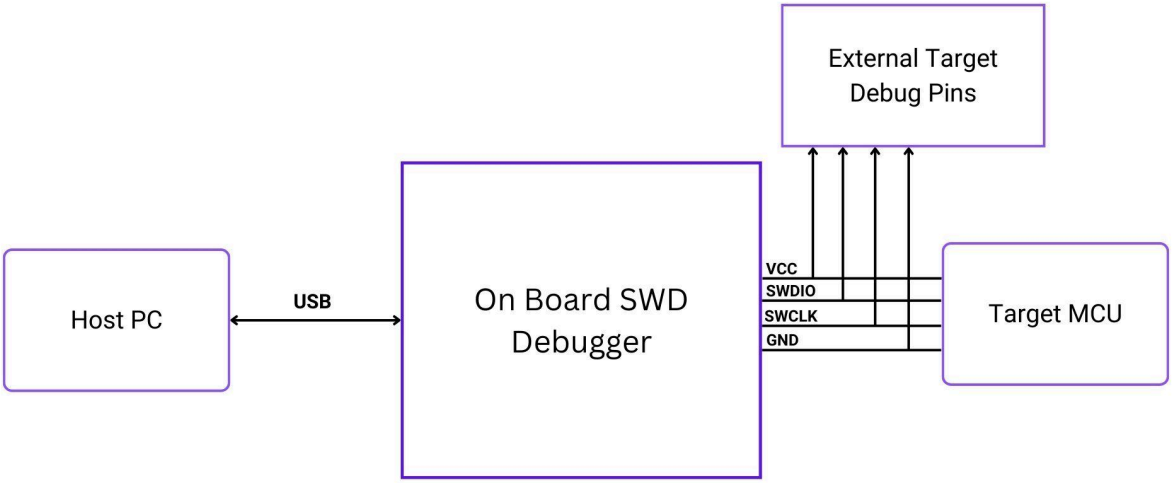

Figure 3.4: User Buttons and LED

3.6 Connectors

The Uni-Kit features a USB Type-B connector, 20 breakout pads, a mikroBUS connector for connecting mikroBUS add-on boards, and a Qwiic connector for connecting Qwiic Connect System hardware. The connectors are placed on the top side of the board, and their placement and pinout are shown in the figure below. For additional information on the connectors, see the following sub-chapters.

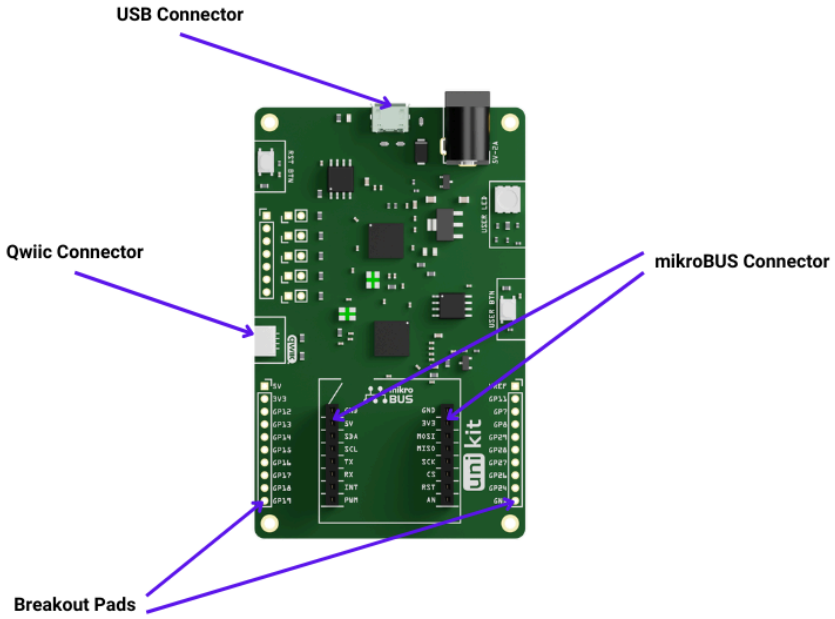

Figure 3.5: Uni-Kit Connector

3.6.1 Breakout Pads

Twenty breakout pads are provided and allow connection of external peripherals. There are 10 pads on the left side of the board and 10 pads on the right. The breakout pads contain a number of I/O pins that can be used with most of the RP2040 features. Additionally, the 5V (main board power rail), 3V3 (LDO regulator output) and VREF (ADC positive reference voltage input) are also exposed on the pads.

The table below includes an overview of the breakout pads that are shared with the kit.

Pin	Connection	Shared Feature
	LEFT SIDE BREAKOUT PINS	
1	5V	5V Output, Input Pin
2	3V3	3V3 Output Pin
3	GP12	SPI1 RX, UART0 TX, I2C0 SDA, PWM6 A
4	GP13	SPI1 CS, UART0 RX, I2C0 SCL, PWM6 B
5	GP14	SPI1 SCK, I2C1 SDA,PWM7 A
6	GP15	SPI1 TX, 12C1 SCL, PWM7 B
7	GP16	SPI0 RX, UART0 TX, I2C0 SDA, PWM0 A
8	GP17	SPI0 CS, UART0 RX, I2C0 SCL,PWM0 B
9	GP18	SPI0 SCK, I2C1 SDA,PWM1 A
10	GP19	SPI0 TX, I2C1 SCL, PWM1 B
	RIGHT SIDE BREAKOUT PINS	
1	VREF	ADC Reference Voltage
2	GP11	SPI1 TX, I2C1 SCL, PWM5 B
3	GP7	SPI0 TX, I2C1 SCL, PWM3 B
4	GP8	SPI1 RX, PWM4 A
5	GP29	SPI1 CS, UART0 RX, I2C0 SCL, PWM6 B, ADC3
6	GP28	SPI1 RX, UART0 TX,I2C0 SDA, PWM6 A, ADC2
7	GP27	SPI1 TX, I2C1 SCL, PWM5 B, ADC1
8	GP26	SPI1 SCK, I2C1 SDA, PWM5 A, ADC0
9	GP24	PWM4 B
10	GND	Ground

Table 3.1. Breakout Pads Pinout

3.6.2 MikroBUS Socket

The Uni-Kit features a mikroBUS socket compatible with mikroBUS add-on boards. MikroBUS add-on boards can expand the functionality of the kit with peripherals such as sensors and LCDs. Add-on boards follow the mikroBUS socket pin mapping and communicate with the on-kit RP2040 through UART, SPI or I2C. Several GPIOs are exposed on the mikroBUS socket.

MikroBUS add-on boards can be powered by the 5V or V_{MCU} power rails, which are available on the mikroBUS socket.

The pinout of the RP2040 on the kit is made such that all required peripherals are available on the mikroBUS socket. The I2C signals are, however, shared with the Qwiic connector, and all mikroBUS signals are also routed to adjacent breakout pads.

When inserting a mikroBUS add-on board, refer to the orientation notch on the Uni-Kit, shown in the figure below, to ensure correct orientation. Add-on boards have a similar notch that needs to be lined up with the one shown below.

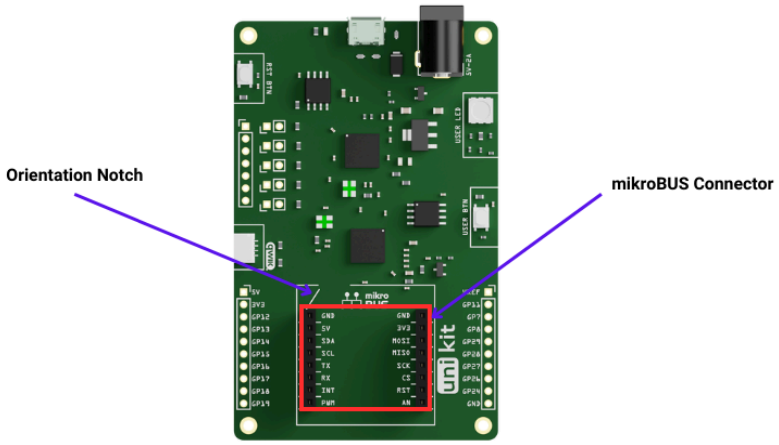

Figure 3.6: mikroBUS Add-on Board Orientation

The table below gives an overview of the mikroBUS socket pin connections to the RP2040.

mikroBUS Pin Name	mikroBUS Pin Function	Connection
AN	Analog	GP26
RST	Reset	GP24
CS	SPI Chip Select	GP09
SCK	SPI Clock	GP10
MISO	SPI Main Input Secondary Output	GP08
MOSI	SPI Main Output Secondary Input	GP11
PWM	PWM Output	GP19
INT	Hardware Interrupt	GP18
RX	UART Receive	GP21
TX	UART Transmit	GP20
SCL	I2C Clock	GP23

SDA	I2C Data	GP22
3V3	VCC 3.3V power	3v3
5V	VCC 5V power	5v
GND	Reference Ground	GND

Table 3.2 : mikroBUS Socket Pinout

3.6.3 Qwiic Connector

The Uni-Kit features a Qwiic connector compatible with Qwiic Connect System hardware. The Qwiic connector provides an easy way to expand the functionality of the Uni-Kit with sensors, LCDs, and other peripherals over the I2C interface. The Qwiic connector is a 4-pin polarized JST connector, which ensures the cable is inserted the right way.

Qwiic Connect System hardware is daisy chain-able as long as each I2C device in the chain has a unique I2C address.

Note: The Qwiic I2C lines are shared with the on-board I2C sensors, and are also exposed on the breakout pads.

The Qwiic connector and its connections to Qwiic cables and the RP2040 are illustrated in the figure below.

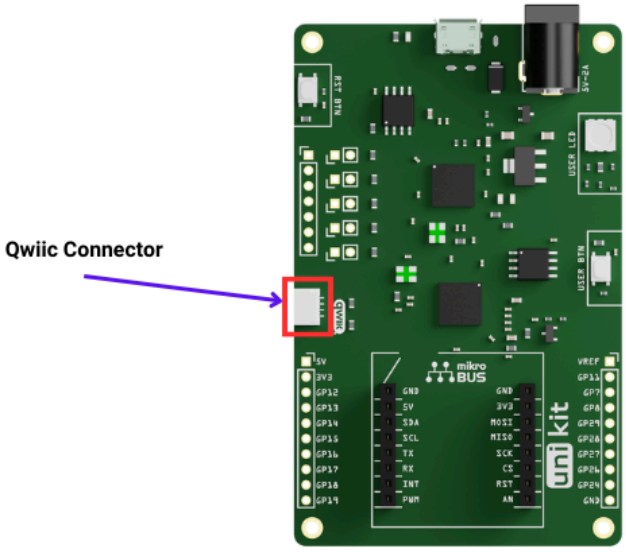

Figure 3.7: Qwiic Connector

The table below gives an overview of the Qwiic connections to the RP2040.

Qwiic Pin	Connection	Shared Features
Ground	GND	Ground
3.3V	3v3	
SDA	GP22	
SCL	GP23	

Table 3.3: Qwiic Connector Pinout

3.6.4 Debug USB Type-B Connector

The debug USB port can be used for uploading code, debugging, and as a Virtual COM port. More information is available in section 4. Debugging.

4. Debugging

The Uni-Kit contains an on-board Debugger that interfaces to the target RP2040 using the Serial Wire Debug (SWD) interface. The debugger allows the user to download code and debug applications running in the target RP2040.

Additionally, it provides a virtual COM port (VCOM) to the host computer that is connected to the target device's serial port for general-purpose communication between the running application and the host computer. The onboard debugger is accessible through the USB Type-B Micro connector.

4.1 On-Board Debugger

The on-board debugger is a debugger firmware running on an RP2040. The debugger is directly connected to the debug and VCOM pins of the target RP2040.

When the debug USB cable is inserted, the on-board debugger is automatically activated and takes control of the debug and VCOM interfaces. This means that debug and communication will not work with an external debugger connected at the same time. The onboard LDO is also activated, providing power to the board.

4.2 Virtual COM Port

The virtual COM port is a connection to a UART of the target RP2040 and allows serial data to be sent and received from the device. The onboard debugger presents this as a virtual COM port on the host computer that shows up when the USB cable is inserted.

Data is transferred between the host computer and the debugger through the USB connection, which emulates a serial port using the USB Communication Device Class (CDC). From the debugger, the data is passed on to the target device through a physical UART connection.