User’s Manual

Contents

Features

RP2040 Microcontroller

- 133MHz 32bit Dual Core Arm® Cortex®-M0+
- 246KB on-chip SRAM
- Direct Memory Access (DMA) controller
- Support for up to 16MB of off-chip Flash memory via dedicated QSPI bus
- USB 1.1 controller and PHY, with host and device support
- 8 PIO state machines
- Programmable IO (PIO) for extended peripheral support
- 4 channel ADC with internal temperature sensor, 0.5 MSa/s, 12-bit conversion
- SWD Debugging
- 2 on-chip PLLs to generate USB and core clock
- 40nm process node
- Multiple low power mode support
- USB 1.1 Host/Device
- Internal Voltage Regulator to supply the core voltage
- Advanced High-performance Bus (AHB)/Advanced Peripheral Bus (APB)

RGB led

- Common Anode
- Connected to onboard target RP2040 GPIO

Temperature sensor

- Uses the I^2C interface
- 12-bit, 0.0625°C resolution
- Typical temperature accuracy of ±0.5°C
- 3.3V sensor
- Supports up to four TMP102 sensors on the I^2C bus at a time

I/O

- 20x Digital Pin
- 4x Analog Pin
- Micro USB
- UART, SPI, I2C Support

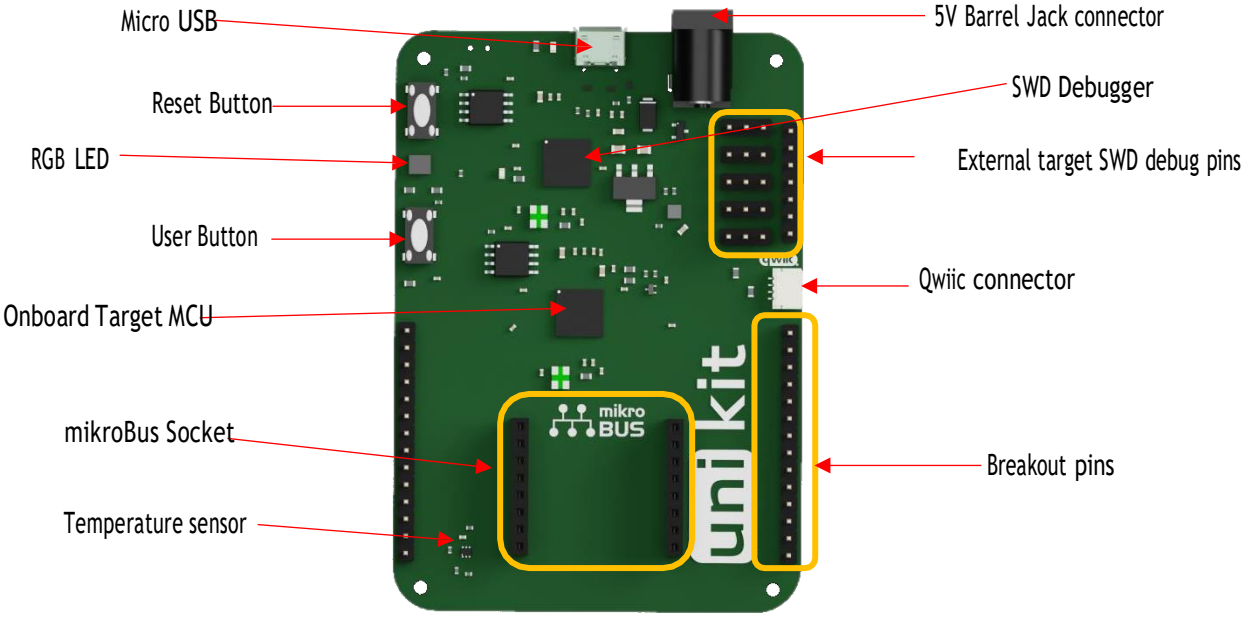
Power

- Onboard 5v to 3.3v LDO

External Debug support

- Dedicated onboard debug pins to debug external target using SWD

1. The Board



1.1 Introduction

The UNI-KIT is a low cost, small form factor prototype and development platform based on an ARM Cortex-M0+ processor. Make the most of the dual core 32-bit Arm® Cortex®-M0+ to make *Internet of Things projects with Bluetooth and Wi-Fi connectivity. Dive into real-world projects with the onboard temperature sensor, RGB LED and user button. Develop robust embedded AI solutions with minimal effort using UNI-KIT!

1.2 Target Areas

*Internet of Things (IoT), Machine learning, Prototyping

Note: *Feature can be enabled only using UNI-WiFi breakout board.

1.3 Getting Started

Detailed instructions for how to get started with your new UNI-KIT can be found on the UNI-KIT web page:

www.uni-kit.in

1.4 Hardware content

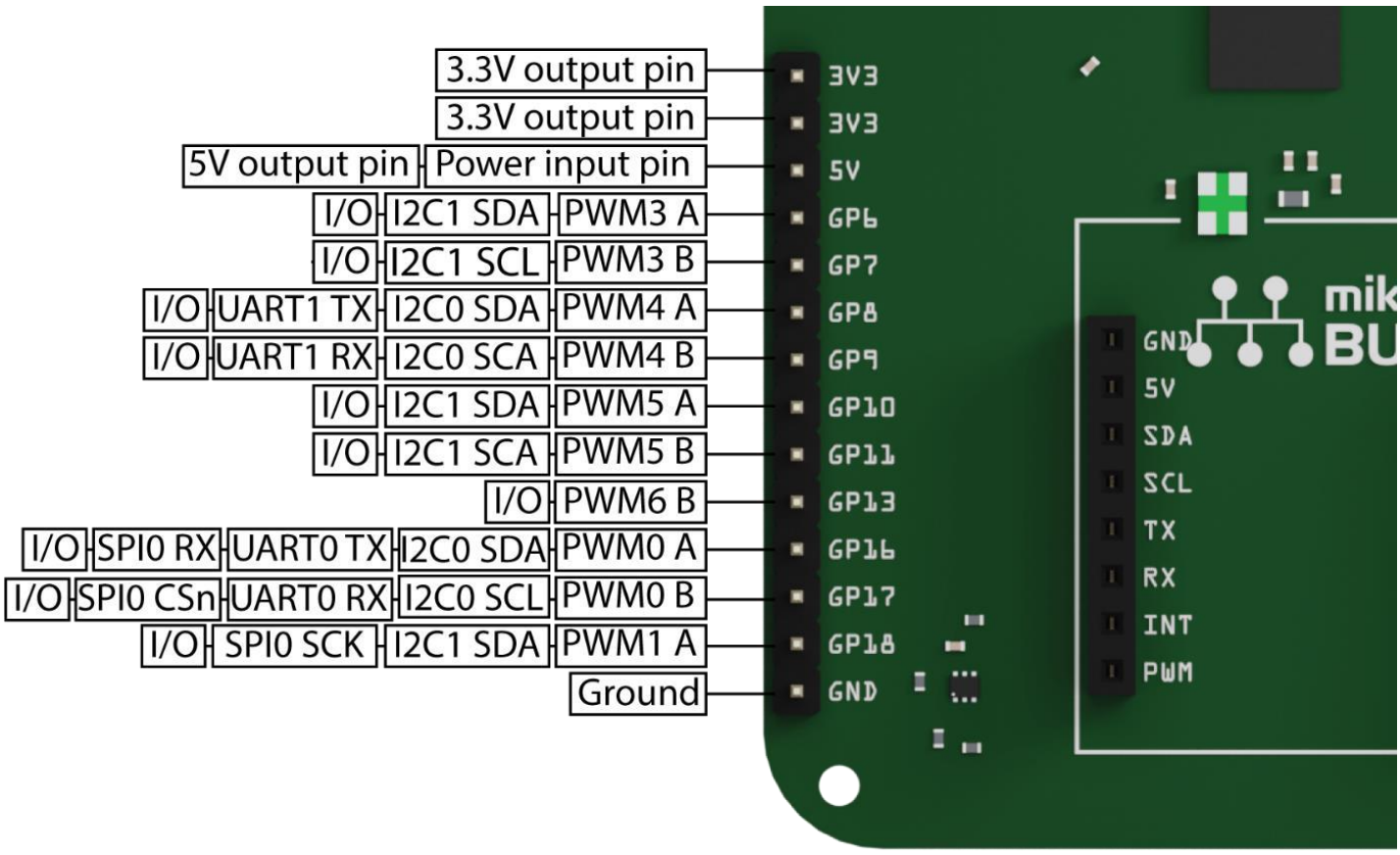
The following key hardware elements are included on the UNI-KIT

- RP2040 Target MCU with 133MHz, 246KB on-chip SRAM and 2MB flash.
- Onboard SWD debugger for easy programming and debugging.
- RGB LED.
- User Button.
- Reset button.
- Breakout pads for GPIO access and connection to external hardware.
- Mikro bus and qwiic connector for easy plug and play setup.
- Barrel jack connector for external 5v power supply.

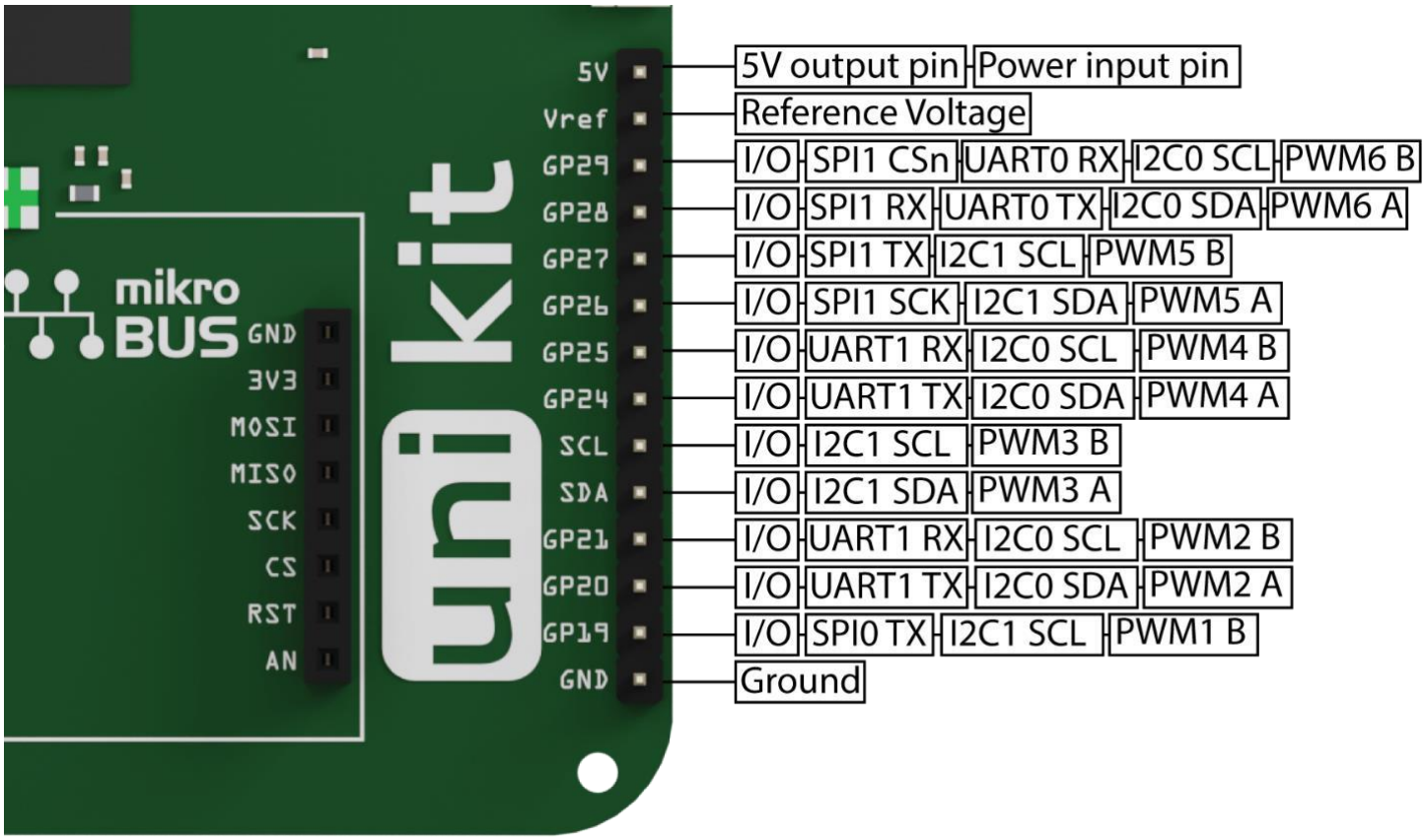
1.5 Pinout diagram

Detailed description of each breakout pins is given in section 4.1 and 4.2 respectively.

Left side breakout pinout diagram is shown below



Right side breakout pinout diagram is shown below



2. Ratings

2.1 Recommended operating conditions

Symbol	Description	Min	Typ	Max	Unit
V_{EXT}	Input voltage from barrel jack connector	-	5V	-	V
V_{USB}	Input voltage from USB connector	4.75	5	5.25	V
V_{BOARD}	Board supply voltage	-	5	-	V
I_{BOARD}	Board supply current	320	1500	2000	mA
T_{OP}	Operating Temperature	-20	-	80	°C

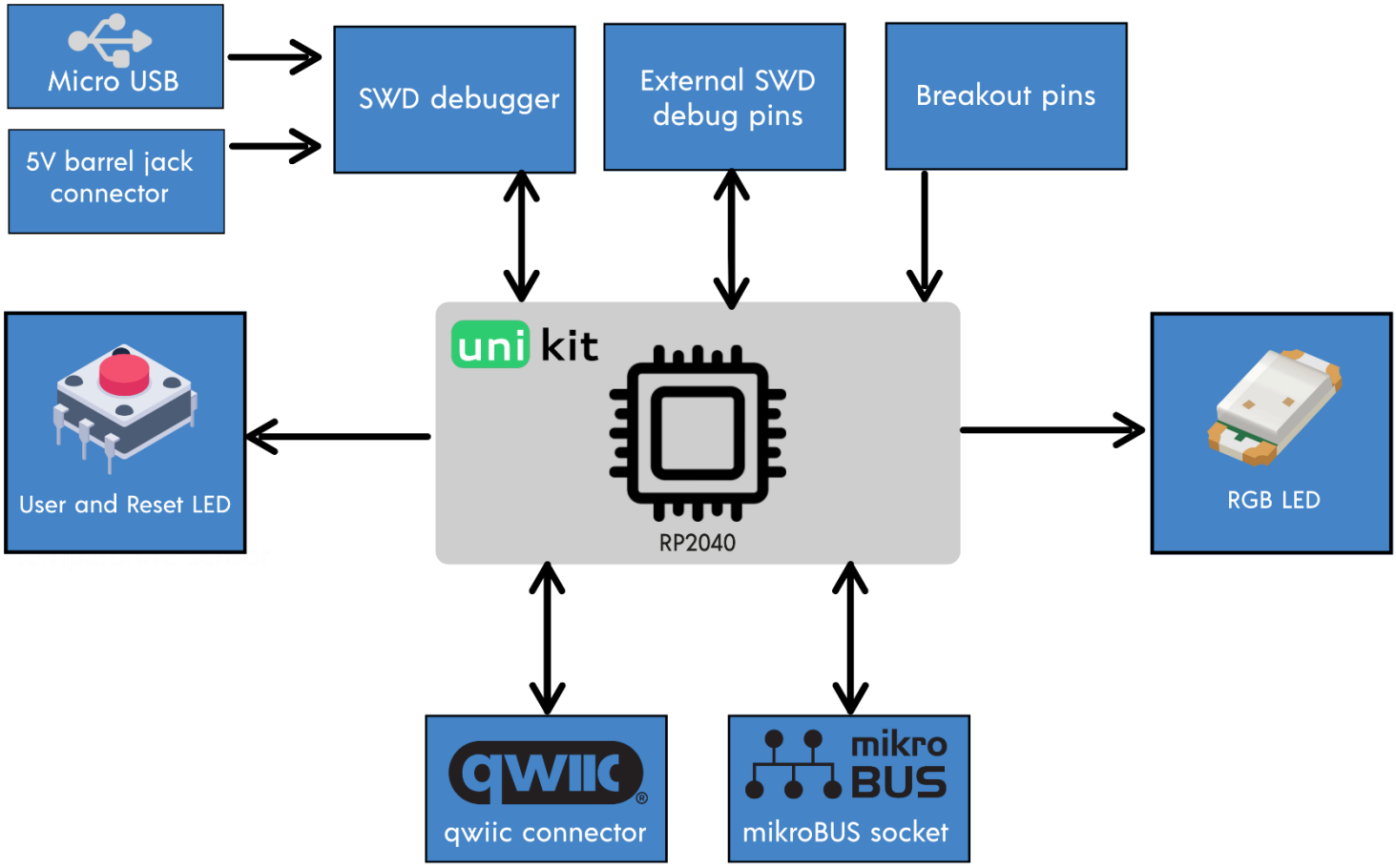
2.2 Power consumption

Symbol	Description	Min	Typ	Max	Unit
P_{BL}	Power consumption with busy loop		TBC		mW
P_{LP}	Power consumption in low power mode		TBC		mW
P_{MAX}	Maximum Power Consumption		TBC		mW

3. Functional overview

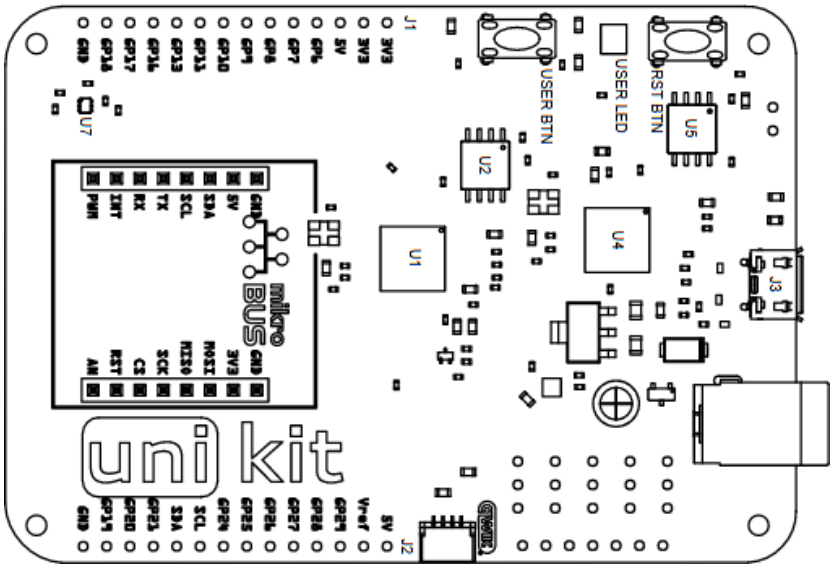
3.1 Block diagram

An overview of the UNI-KIT is illustrated in the figure below.



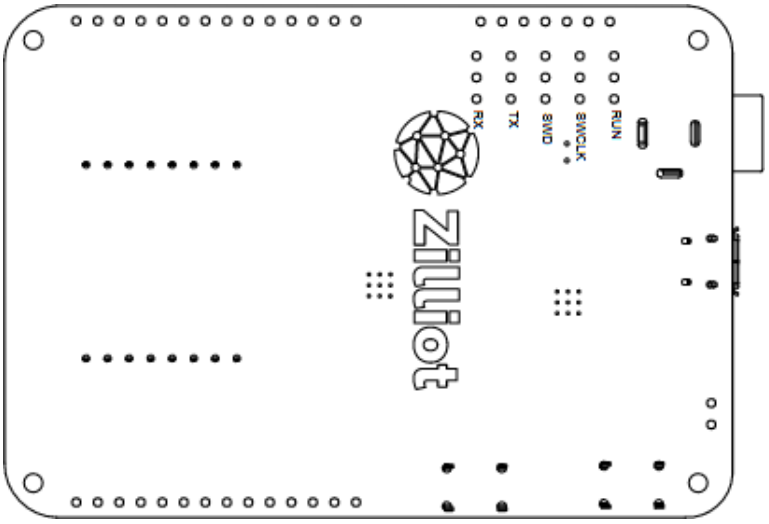
3.2 Board Topology

Front View



Ref	Description	Ref	Description
U1	Target MCU	J1	GPIO pins
U2	Target MCU flash chip	J2	GPIO pins
U4	Debugger MCU	J3	Male micro-USB connector
U5	Debugger MCU flash chip	RST BTN	Target/ext Target MCU Reset button
USER BTN	User configurable button	USER LED	User RGB LED

Back view

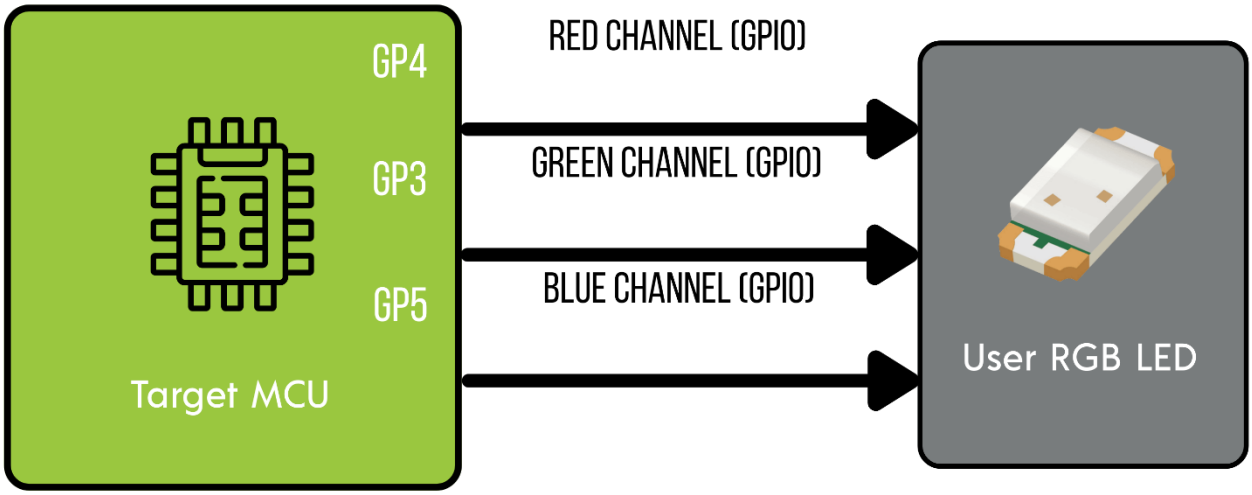


Ref	Description
RUN	Ext Reset pin
SWD	Serial wire data pin
SWCLK	Serial wire clock pin
TX	External target MCU UART TX pin
RX	External target MCU UART RX pin

3.3 Processor

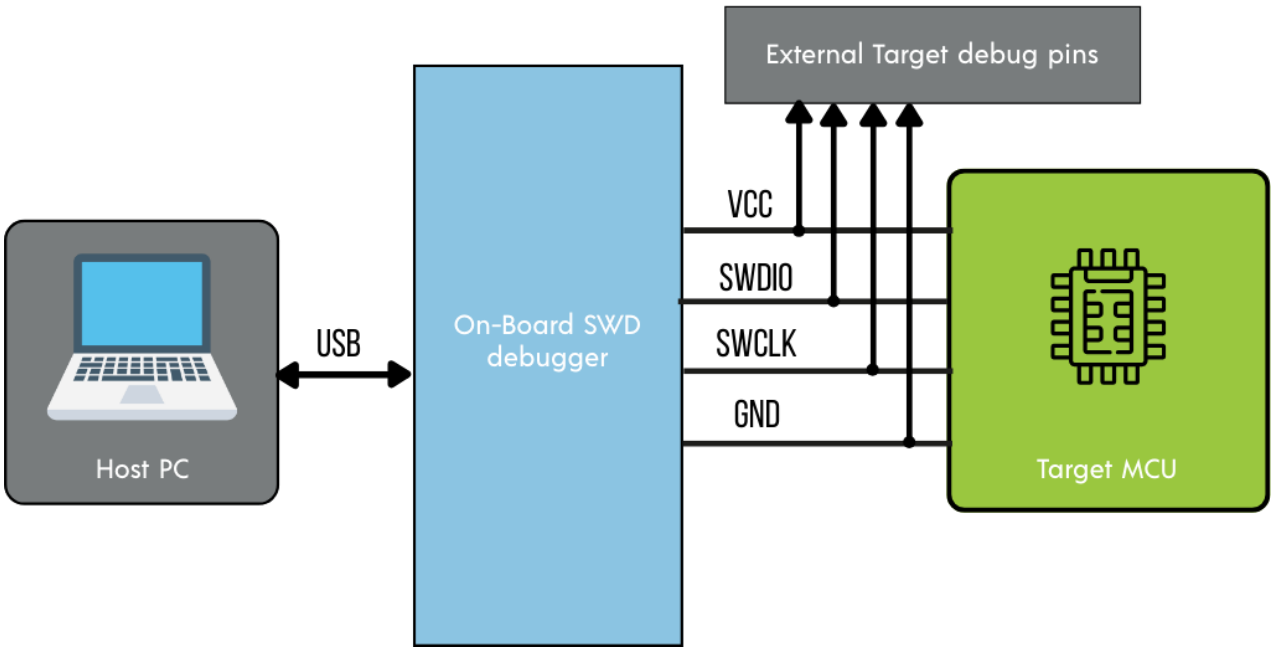
The processor is based upon the new RP2040 silicon (U1). This microcontroller provides opportunities for low-power Internet of Things (IoT) development and embedded machine learning. Two symmetric Arm® Cortex®-M0+ clocked at 133MHz provide computation power for embedded machine learning and parallel processing with low power consumption. Six independent banks of 264 KB SRAM and 2MB are provided. Direct memory access provides fast interconnect between the processors and the memory that can be made inactive along with the core to enter a sleep state. Serial wire debug (SWD) is available from boot via the pads under the board. The RP2040 runs at 3.3V and has an internal voltage regulator providing 1.1V.

3.4 RGB LED



The RGB LED is a common anode LED that is connected to the target MCU through three GPIO pins. RED channel is connected through GPIO4, GREEN channel is connected through GPIO3 and BLUE channel is connected through GPIO5. The LED are off when the digital state is HIGH and on when the digital state is LOW.

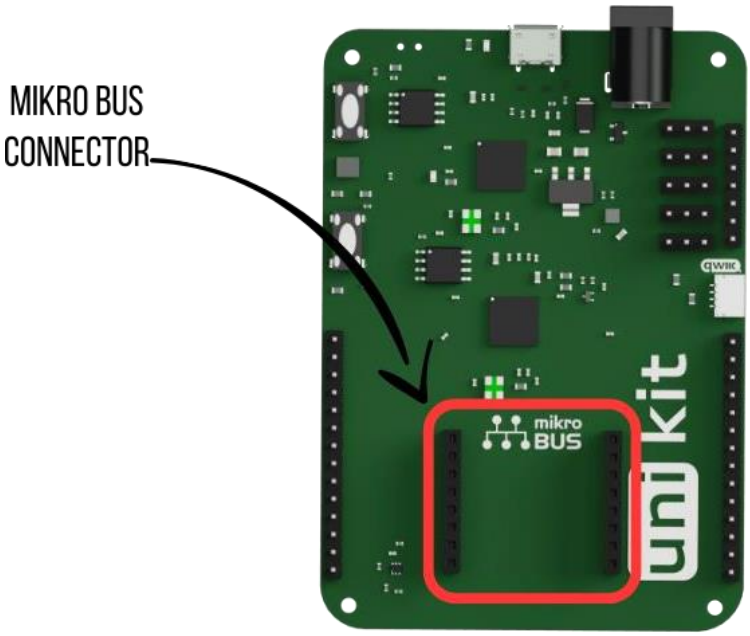
3.5 On-board Debugger



The UNI-KIT board contains an on-board Debugger that interfaces to the target MCU using the Serial Wire Debug (SWD) interface. The debugger allows the user to download code and debug applications running in the target MCU. Additionally, it also provides a VCOM port 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 on-board debugger is accessible through the USB Micro-B connector.

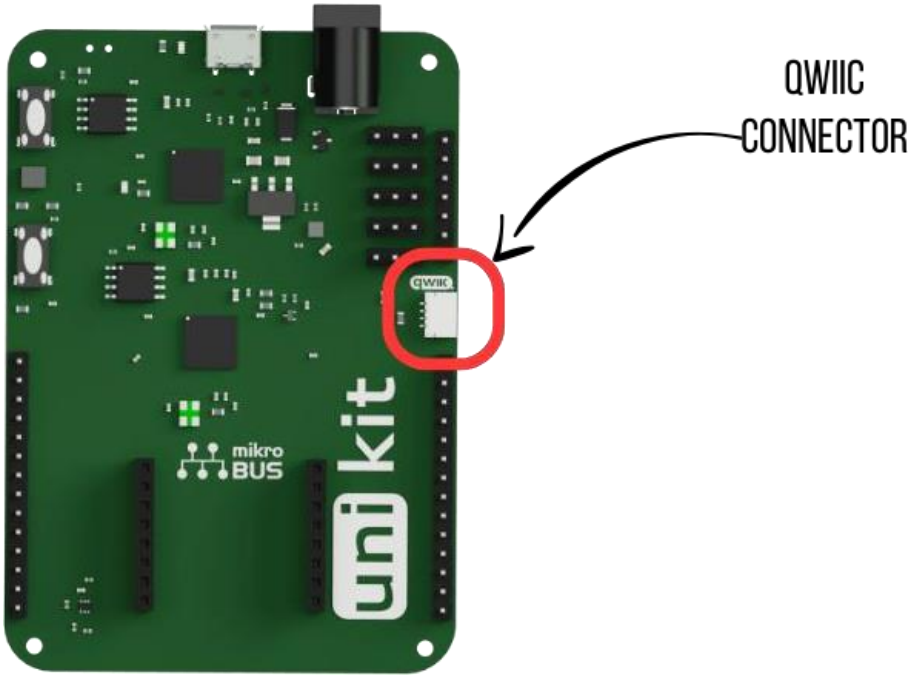
Also, there is provision to debug any external target devices using SWD interface pins. The external target board is powered using debugger board itself.

3.6 Mikro bus



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 target RP2040 mcu through UART, SPI, or I2C. Several GPIOs are exposed on the mikroBUS socket. MikroBUS add-on boards can be powered by the 5V or 3.3v power rails, which are available on the mikroBUS socket.
The pinout of the UNI-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.

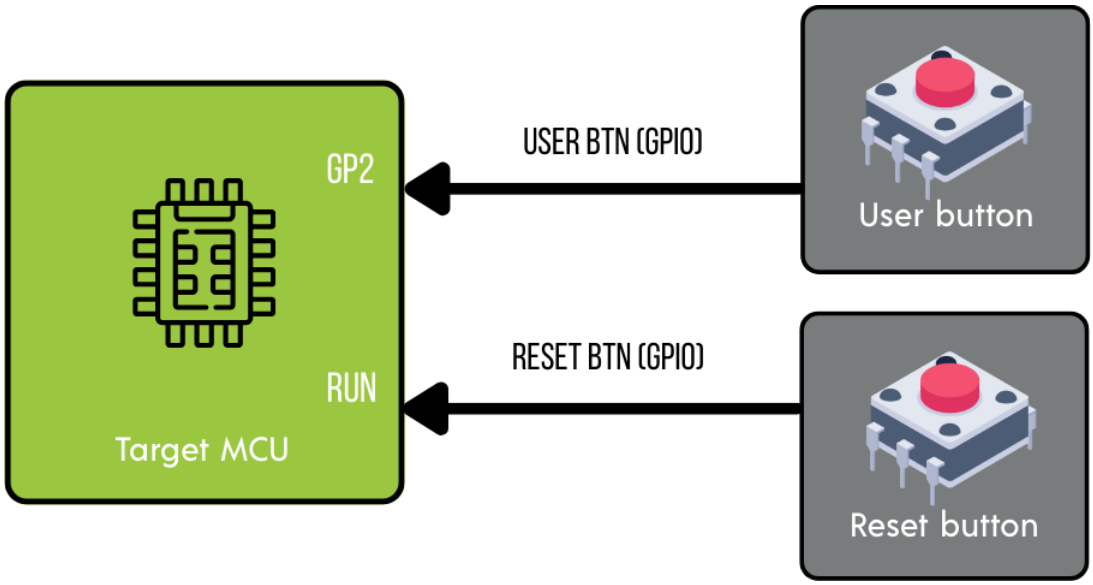
3.7 Qwiic connect system



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 connections on the UNI-KIT are shared with the mikroBUS I2C signals.

3.8 USER and RESET button



The kit has one user push button, marked USER BTN, that is connected to a GPIO on the onboard target MCU. The button is connected to pin GPIO2 and it is debounced by an RC filter with a time constant of 0.01 ms. The logic state of the button is high while the button is not being pressed, and low when the button is pressed.

The kit also has one reset push button, marked RST BTN, that is connected to a RUN on the onboard target MCU. The logic state of the button is high while the button is not being pressed thus keeping target MCU in run mode, and low when the button is pressed resetting the MCU.

4. Connector Pinouts

4.1 J1 GPIO rack

Pin	Description
5v	5V output pin, Power input pin (5v)
3.3V	3.3V output pin
GP7	I/O, I2C1 SCL, PWM3 B
GP8	I/O, UART1 TX, I2C0 SDA, PWM4 A
GP9	I/O, UART1 RX, I2C0 SCA, PWM4 B
GP10	I/O, I2C1 SDA, PWM5 A
GP11	I/O, I2C1 SCA, PWM5 B
GP13	I/O, PWM6 B
GP16	I/O, SPI0 RX, UART0 TX, I2C0 SDA, PWM0 A
GND	Ground reference pin

4.2 J2 GPIO rack

Pin	Shared Features
Vref	Reference voltage for internal adc
GP29	I/O, SPI1 CSn, UART0 RX, I2C0 SCL, PWM6 B
GP28	I/O, SPI1 RX, UART0 TX, I2C0 SDA, PWM6 A
GP27	I/O, SPI1 TX, I2C1 SCL, PWM5 B
GP26	I/O, SPI1 SCK, I2C1 SDA, PWM5 A
GP25	I/O, UART1 RX, I2C0 SCL, PWM4 B
GP24	I/O, UART1 TX, I2C0 SDA, PWM4 A
GP19	I/O, SPI0 TX, I2C1 SCL, PWM1 B
GP18	I/O, SPI0 SCK, I2C1 SDA, PWM1 A
GP17	I/O, SPI0 CSn, UART0 RX, I2C0 SCL, PWM0 B

4.3 J11 SWD pins

Pin	Description
GND	External target ground reference pin
RUN/RESET	Reset the External target device
SWCLK	External target Serial wire clock debug pin
SWD	External target Serial wire data debug pin
TX	External target UART TX pin
RX	External target UART RX pin
5v	Pin to Power external target MCU

4.4 Quiic connector

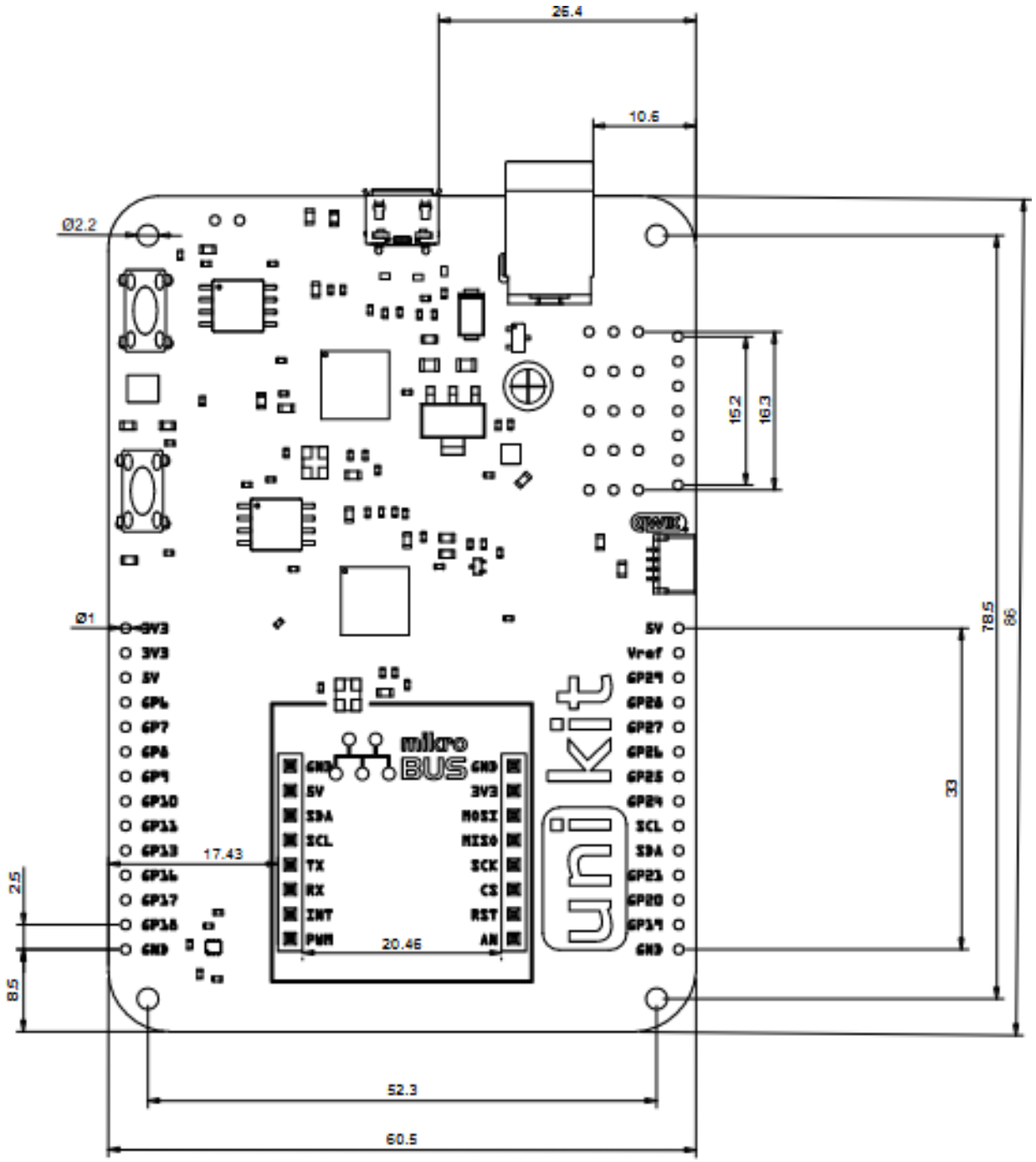
Connector pins	Peripheral mapping
GND	Ground
3v3	UNI-KIT voltage domain
SDA	GP22
SCL	GP23

4.5 MikroBus socket

MikroBus Pin Name	MikroBus pin function	MCU mapping
AN	Analog	GP26
RST	Reset	GP7
CS	SPI Chip Select	GP9
SCK	SPI clock	GP10
MISO	SPI Main Input Secondary Output	GP8
MOSI	SPI Main Input Secondary Input	GP11
PWM	Pulse Width Modulation Output	GP18
INT	Hardware Interrupt	GP19
RX	UART Receive	GP21
TX	UART Transmit	GP20

SCL	I2C Clock	GP23
SDA	I2C Data	GP22
3v3	VCC 3.3V power	UNI-KIT voltage domain
5V	VCC 5V power	Board USB/Barrel jack
GND	Reference Ground	Ground

5. Mechanical Information



Note: All dimensions are in mm.